SMC Quarterly News

Stand Management Cooperative
School of Forest Resources, University of Washington
3rd Quarter 2010

www.standmgt.org

Dave Briggs, SMC Director

From the Director

Due to a heavy load of meetings during April-May, the search for a new Dean for the College of the Environment, and the usual mess at the end of each academic year, we did not get the spring newsletter issue completed. Since we are fairly close to when we would send the summer issue, consider this a combined issue. Hopefully this will not happen again. In this issue, you will find abstracts for 7 new publications, brief descriptions of 4 grants or grant supplements, and a summary of the Spring meeting, the feature article by PhD student Kevin Ceder who has completed work on understory vegetation development patterns of intensively managed plantations using the repeated assessments we have been making on SMC installations. This was funded by the Western Wildlife Program of NCASI. This issue also has a number of announcements.

ANNOUNCEMENTS

Corkery Family Foundation Chair

As most of you know, I was awarded the Corkery Family Foundation Chair in January 2005 when I also became Director of the Precision Forestry Cooperative. The appointment was for 3 years with extension to 5 years depending on performance. I have primarily used the Chair to help underwrite recruitment offers to attract top graduate students to the PFC and SMC, assist with retention, and underwrite summer field crew needs of both cooperatives. The latter included opportunities for undergraduates which has

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led to some of them going on for a graduate degree. Because of the success of this strategy, I was extended to a 5 year term that ends on June 30, 2010. During spring quarter the School of Forest Resources began a process for nominations for the next holder of this Chair. As it turns out, I could apply for a second term, which I did. With a lot of support from other faculty, my application for renewal was accepted and I will continue to hold it until I retire in 2013. This means that we can continue to create packages to attract and support graduate and undergraduate students into the PFC and SMC programs. It does raise the issue of how the level and quality of students can be sustained after my second term.

Fall SMC Policy Committee Meeting

Please note that the Fall 2010 Policy Committee Meeting will be held on September 21-22 at Oregon State University, Corvallis, OR.

SMC Database Available

The SMC database update has been completed and is now available, if you would like a copy and/or would like a tutorial on its structure, accessing the data, and generating reports, contact Randy Collier, SMC database manager rcollier@u.washington.edu.

New Supplier Member

Agrotain International is the world's largest producer of StabilizedNitrogen™ fertilizers. Marketed under the brands AGROTAIN®, AGROTAIN® PLUS, SuperU®, HYDREXX™, UMAXX® and UFLEXX™, StabilizedNitrogen fertilizers contain proprietary nitrogen stabilizer technology that reduce expensive nitrogen losses from volatility and extend plant-available nitrogen for healthier plants and higher yields. Incidentally, volatized N after application has been identified as a major contributor to greenhouse gas emissions associated with seed-to-stump forest management regimes. The representative is Ben Thompson, Director, Industrial and SuperU Sales.

Grant Funding

Title: Effects of Organic Matter Retention & Management on Long-Term Productivity of Pacific Northwest Coastal Douglas-Fir Plantations

Agency: National Council for Air and Stream Improvement

Period: 3/15/2010-12/31/2010

Amount: $24,000

Principal Investigator: Robert Harrison

The goal of this project is to gain a better understanding of the long-term consequences of various levels of organic removals, nutrient allocation, and soil compaction, as well as the appropriate ameliorative or growth enhancement treatments that can be used to sustain productivity through multiple rotations on the Pacific Northwest's most productive soils. Although N fertilization is commonly used in Pacific Northwest Douglas-fir stands for enhancing, it is not known to what extent organic matter will be enhanced by N fertilization through successive applications, or how it compensates for the nitrogen removed from the system through harvest. This study will begin to fill this critical data gap in the Pacific Northwest Region. This addendum is to extend the MOA and supplement this project

Title: Life Cycle Assessment of Forest Carbon Balance of Silvicultural Regimes

Agency: National Council for Air and Stream Improvement

Period: 3/16/2010-12/15/2010

Amount: $15,004

Principal Investigator: David Briggs

This project extends previous research which developed life-cycle analyses (LCA) of silvicultural regimes of intensively managed Douglas-fir and loblolly pine plantations that were based on growth and yield projections using FVS, a model developed by the USFS. This study will use growth and yield models more commonly used by forest industry, specifically LOBDSS for loblolly pine and CONIFERS/ORGANON developed for Douglas-fir. In addition to analysis of regimes used previously, new regimes defined in consultation with industry will also be analyzed. The project will also develop a method for incremental analysis focusing on change within a regime with stand age and change between regimes. Areas requiring further fundamental process LCA will be identified.

Title: Additional site characterization and instrumentation of SMC/CIPS Paired Tree Fertilization Projects.

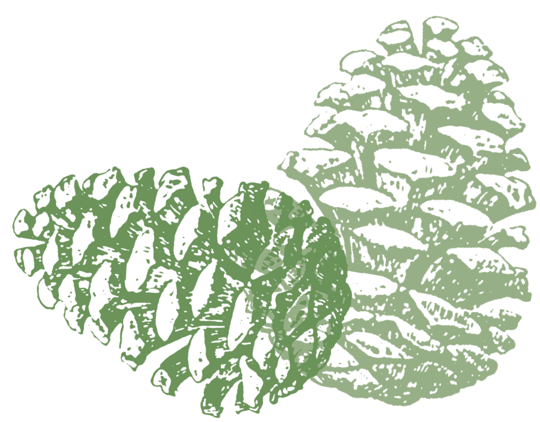
Agency: USFS PNWRS Agenda 2020

Period: 2010

Amount $25,000. Brings UW total to $75,000 for 2008-2010; OSU total for 2008-2010 also $75,000. Total budget $150,000.

Investigators: Rob Harrison (UW), Doug Maguire (OSU), Eini Lowell (USFS-PNWRS), Dave Briggs (SMC), Doug Mainwaring (OSU), Eric Turnblom (UW), and Kim Littke (UW).

Several decades of research by the Regional Forest Nutrition Research Project (RFNRP), as well as other studies of N fertilization of Douglas-fir, have shown that coastal Douglas-fir will respond to 224 Kg N/ha applications about 2/3 of the time. If fertilization could be concentrated into the top half of responding stands, the average response could be increased to about 25-30%. Given the potential gain in management efficiency, the SMC recently approved a paired-tree study consisting of two treatments, 0 and 224 Kg N/ha. These studies are currently being installed, with a target of 15 installations measured and fertilized before the 2008 growing season, and a target of 40 over the next three years. With support from Agenda 2020, we propose to add instrumentation current CIPS and SMC paired-tree research sites, enhance LAI measurements, and sample wood quality. Instrumentation would include rainfall, air temperature, air humidity, soil temperature, and soil moisture gauges. Additional funding would also allow standing-tree and felled-tree research sapwood and wood density measurements. Inclusion of sapwood measurements would facilitate analysis of LAI as a possible indicator of fertilizer response. Further funding would also allow measurement of wood density in the period after fertilization to help determine fertilization impacts on wood quality. Funding will also include "fate-of-applied-N" studies that include lysimetery to determine N loss after fertilization and changes in N mineralization rates as indicators of response to N.



2010-2011 FIELD WORK

The schedule for work planned for the 2010-2011 field season is tabulated below.

If you have any questions contact Bob Gonyea bgonyea@u.washington.edu

Inst.	Inst. Name	Job	Organization
701	Mason Lake	Full Measurement	Green Diamond
702	Adam River	Full Measurement	B.C.
703	Longbell Road	Full Measurement	Wash. DNR
706	B & U Plantation	RD check 5	Weyerhaeuser
708	Copper Creek	RD check plot 7, 9	Port Blakely
709	Mill Creek	RD check plot 4, 5	Weyerhaeuser
711	Kitten Knob	RD check plot 1, 2, 6	Wash. DNR
712	Prather creek	RD check plot 1	Weyerhaeuser
713	Saulk Mt.	RD check plot 1, 7, 12	Trillium
714	Mahatta River	RD check plot 3, 5	B.C.
715	Davie River	RD check plot 5	B.C.
718	Roaring River	RD check plot 3, 4,5	Weyerhaeuser
725	Sandy Shore	Full Measurement	Olympic Resources
		RD check plot 1,4,6,9,10	
726	Toledo	Full Measurement	Plum Creek
		RD check plots 1	
727	American Mill	Full Measurement	Rayonier
		RD check plot 1	
728	LaPush	Full Measurement	Rayonier
729	Gnat Creek	Full Measurement	Oregon Dept. of Forestry
		RD check plot 1	
730	Big River	Full Measurement	Green Crow
		Rd check plot 5	
731	Dingle 4	Full Measurement	U.S.F.S.
		RD check plots 4,7	
732	100-lens creek	Full Measurement	B.C.
		RD check plot 2	
733	Stowe Creek	Full Measurement	B.C.
736	Twin Peaks	RD check plot 5,6	Hancock

Type II			
Inst.	Inst. Name	Job	Organization
802	Catt Creek	Full Measurement	Wash. DNR
806	Elk Creek	Full Measurement	Longview Fibre
812	Panther Creek	Full Measurement	U.S.F.S.

Type III			
Inst.	Inst. Name	Job	Organization
905	LaVerne Park	Measure plots 1,2,3,	Plum Creek
		7,8,9 Thin plot 12	
914	Lewisburg Saddle	Measure plot 11	Oregon State University

2010-2011 FIELD WORK cont.			
915	Big Tree	Full Measurement	Weyerhaeuser
922	Holder	Full Measurement	Wash. DNR
930	Forks #1	Full Measurement	Rayonier
931	Forks #2	Full Measurement	Rayonier
932	Forks #3	Full Measurement	Rayonier
937	Ames Creek	Measure plots 1,2,3,	Cascade Timber Consultants
		7,8,9	
942	Cat Ballew	Measure plots 1,2,3,	Wash. DNR
		7,8,9,13,14,15,20,21,22	

Inst.	Inst. Name	Job	Organization
Inst. 601	Donkey Creek	Full Measurement	Rayonier
Inst. 602	Donaldson Creek	Full Measurement	Green Crow
Inst. 603	Crane Creek #2	Full Measurement	Quinault Indians

Type V			
Inst.	Inst. Name	Job	Organization
827	Nestucca	Full Measurement	Weyerhaeuser
828	Bunker Creek	Full Measurement	Weyerhaeuser
829	Grants Pass	Full Measurement	Weyerhaeuser
830	Weikswoods Flat	Full Measurement	Weyerhaeuser
831	Rancho Ranchera PP	Full Measurement	Plum Creek
832	Clarke Creek PP	Full Measurement	Plum Creek
833	Clarke Creek DF	Full Measurement	Plum Creek
834	Dudley	Full Measurement	Plum Creek
835	Weikswoods Slope	Full Measurement	Weyerhaeuser
836	Rabbit Creek	Full Measurement	Green Diamond
837	Mill Creek #2	Full Measurement	Green Diamond
838	Star Lake	Full Measurement	Green Diamond
839	Russel Ranch	Full Measurement	Wash. DNR
840	Coyote Ridge	Full Measurement	Wash. DNR
841	Cascadia Tree Farm	Full Measurement	Cascade Timber Consultants
842	Scott Mountain	Full Measurement	Cascade Timber Consultants
843	DeVore Mountain	Full Measurement	Lone Rock Timber
844	Brush Creek	Full Measurement	Lone Rock Timber
845	Hanes Ranch	Full Measurement	Roseburg Lumber
846	Armstron-Janicki	Full Measurement	Pilchuck Tree Farms
847	Victoria	Full Measurement	Pilchuck Tree Farms
848	McKinely	Full Measurement	Pilchuck Tree Farms
849	Pender Harbor	Full Measurement	B.C.
850	Steel Creek	Full Measurement	B.C.
851	Upper Campbell	Full Measurement	B.C.
852	Fanny Bay	Full Measurement	B.C.
853	Copper Canyon 1	Full Measurement	B.C.
855	Copper Canyon 2	Full Measurement	B.C.

SUMMARY OF THE SPRING POLICY COMMITTEE MEETING

The meeting, at the Olympic National Forest Headquarters in Olympia, WA., had 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 from Kirkland, WA 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.
- 7 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.

Budget

The final 2009 budget 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

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. *That the Strategic Planning Committee examine concerns regarding restitution for unpaid dues and make recommendations for inclusion in the SMC By Laws.*
5. *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.*

Projection of the 2010 budget indicates that it is on track to meet the $20,000 ending balance target. 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

The Strategic Planning Committee held a meeting in January after the TAC's had held meetings. This led to an updated draft which was reviewed. Small editing changes were suggested for Goals 1-5 and 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.

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 response estimates
- 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: presently 60 installations have been created; Kim Littke presented a status report in the afternoon session. A final $25,000 from AGENDA 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 LTSP.
    - ➢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 to support graduate students.

Silviculture Project Report: Eric Turnblom

A. 2009/10 Field Season Summary

68 installations (422 plots) measured, including 2 installations (12 plots) in BC measured by BC Ministry of Forests. Also includes second measurement of 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 herbicide treatment. This matches the number of herbicide treatments, 5 growing seasons, 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 and 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

1. 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.
2. Model Validation: Benchmarking Douglas-fir growth and yield models. Co-PIs are Greg Johnson, Dave Hamlin, David Marshall, and Eric Turnblom. A plan has been developed with the following 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.

3. LOGS style performance summaries of Type I, II, and III installations. The desired controls and structure of these summary reports 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 resubmitted. 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)

- 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, PNWTIRC Reports 26 and 27, published in 2007, an article in the Canadian Journal of Forest Research published in 2008, and submission of the following

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

- 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. This led to a 2008 article in the proceedings of the 15th International Symposium on Nondestructive Testing of Wood, and an 2010 article by Christine Todoroki, Eini Lowell and Dennis Dyksta, (abstract is on page 25).

Analysis Underway

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

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

A compressive 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 Cooperative and the SMC.

- Sample consists of 4 LOGS Installations3 treatments (thinning regimes and control); 3 plots per treatment; 15 trees per plot, (135 trees/installation).
- ST300 acoustic velocity data collection has been completed and a summary was presented during the technical session.
- UW obtained a Resistograph and will collect data this spring/summer.
- Increment cores have been collected from a sub-sample of trees on 1 site. The balance will be collected when 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

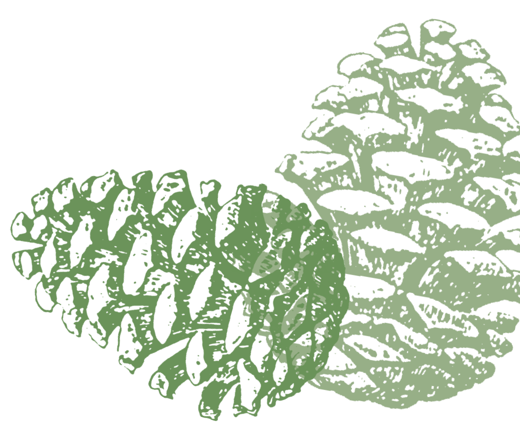
- Wood quality measurements, including acoustic velocity and wood density, will be obtained after treatments have been implemented and sufficient post-treatment growing seasons have elapsed. Destructive sampling is not envisioned without supplemental grant funds.
- Terrestrial Lidar is not being collected due to expense and stand density issues. 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 for using a transect of SMC installations 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. work

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 young and still develop ing. 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 1C: *Develop Field Procedure Manual.* Does wood quality need standardization for new procedures? It was felt that protocols should 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 a 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.

SMC Vegetation Data Collection Results in Understory Vegetation Models

Kevin R. Ceder and Eric C. Turnblom

Introduction

Understory vegetation in young stands is often regarded as a problem because it competes with trees and may reduce tree growth, which can be remedied with herbicides to maximize growing space for trees. An alternative view is that 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.

Lacking models of understory vegetation cover and composition in young stands, more data collection is required to get this information, adding another cost to forest management. An efficient solution is to develop models that use readily available operational forest inventory data to predict vegetation cover and composition.

Beginning with the inception of the Type III installations, the SMC had the fore thought to begin collecting understory vegetation data knowing that questions about wildlife habitat and biodiversity would become important forest management questions. Our study[1] has resulted in a set of models to predict understory vegetation cover and composition in these young, managed stands to help address these questions.

Methods

At the establishment of each Type III installation four vegetation 1/100th acre subplots, each containing four-1/400th-acre quadrants were placed in each plot. On each quadrant all understory vegetation with more than 1% cover was identified by species and the total cover of the species was ocularly estimated. Measurements occurred at establishment, every two years after establishment for the next four years, and every four years after that during the summer following tree measurements undertaken during the prior dormant season. The resulting data set provides a time-series of up to 14 years showing the trajectories of vegetation development as the stands develop.

[1]Funding provided by the National Council of Air and Stream Improvement Western Wildlife Program.

Type III data are heavy to young, open stands where development of the vegetation community is highly dynamic. Understory vegetation is developing with little influence from the trees, which have not yet captured the site. A few Type III stands have begun to close but do not provide enough data to provide good model predictions under these conditions. To help predict expected vegetation in older stands, vegetation subplots and quadrants have been established in Type I and Type II installations.

From the vegetation data mean cover for each plot is calculated for total vegetation cover and cover for each life form (shrubs, ferns, forbs, and grasses). Cover for all are highly variable (table 1) so high predictive ability should not be expected. Nonetheless, models that relate cover to tree variables [basal area (BA), trees per acre (TPA), and top height (TH)], King's site index (SI), and location variables [latitude (Lat), longitude (Long), and elevation (Elev)] are formulated two ways: total cover and life form covers as linear and nonlinear models to predict the proportion of cover represented by each life form, weighted by total cover, to give cover by life form. Using raw and log-transformed variables models are fit using forward stepwise regression, with significance level of 0.1 to enter and exit, and are compared using Akaike's Information Criterion (AIC) in an untransformed space.

Table1: Summary of vegetation cover data used for predictive model parametrization.

Class	Min.	25th%-tile	Med.	Mean	75th%-tile	Max.
Total	0	44	71	76	102	230
Shrubs	1	18	34	39	55	137
Ferns	1	6	13	21	32	90
Forbs	1	6	14	19	26	130
Grasses	1	2	5	10	12	65

Results

Fitting the full suite of models to data and comparing them using AIC gives the best models for total cover and each life form. Statistical significance of estimated parameters is specified by a subscript as $0.00 < a < 0.001 < b < 0.01 < c < 0.05 < d < 0.1$.

The best fit model for total cover is

$$\text{Total} = 3.06255_c \times \text{Elev}^{0.21494_a} \times \exp(-0.01505_a \times \text{BA} + 0.01397_a \times \text{TH} + 0.01822_a \times \text{SI} - 0.00025_a \times \text{Elev})$$

a nonlinear model that explains approximately 51% of the variation in the data. Models for the component covers are all proportional models. Shrub cover is best predicted with

$$\text{Shrub} = \text{Total} \times [-0.06443 - 0.00530_a \times \text{SI} - 0.06725_a \times \text{Lat} + 0.03999_a \times \text{Long} + 0.05896a \times \log(\text{BA} + 1) - 0.04634_a \times \log(\text{TPA} + 1) + 0.01943_d \times \log(\text{Elev} + 1)]$$

a linear model explaining nearly 73% of the variation in the data. Fern cover is best predicted with the nonlinear model

$$\text{Fern} = \text{Total} \times [0.11114 \times \text{TPA}^{0.47158_a} \times \text{Elev}^{0.95771}$$
$$\exp(-0.00119_a \times \text{TPA} + 0.02769_a \times \text{SI} + 0.13888_a \times \text{Lat}$$
$$-0.13079_b \times \text{Long} - 0.00166_a \times \text{Elev})]$$

explaining almost 58% of the variation in the data. Forbs are also best predicted with a nonlinear model

$$\text{Forb} = \text{Total} \times [1.08368 \times \text{TH}^{1.12973_a} \times \text{Elev}^{-0.62583_a}$$
$$\times \exp(-0.10410_a \times \text{TH} - 0.00717_c \times \text{SI} + 0.22515_a \times \text{Lat}$$
$$-0.07467_c \times \text{Long} \text{ “ } 0.00071_a \times \text{Elev})]$$

Explaining 46% of the variation in the data. Finally, the grass model

$$\text{Grass} = \text{Total} \times [0.00029 \times \text{TH}^{-0.36352_b}$$
$$\times \exp(0.01852_c \times \text{SI} + 0.67083_a \times \text{Elev})]$$

Discussion

Our models provide a quantitative picture and give insights into the dynamics of secondary succession in these young forest communities through the signs of the parameters. As stands develop basal area and top height increase with the total cover model predicting decreasing cover as the stand develops (figure 1) with each life form following a similar pattern with shrub cover persisting longer (figure 2) than for ferns, forbs, or grasses (figure 3–5). Compositions of the community in very young stands are expected to have relatively equal proportions of shrubs, ferns, and forbs with a small proportion of grasses. As the stands develop the proportion of shrubs increases while forb and grass proportions decrease quickly and ferns remain relatively consistent.

Development of the vegetation community is generally consistent for any stand condition though location of a stand effects the cover and composition of the vegetation community. Cover is expected to be highest at middle elevations and higher on higher quality sites. Latitude and longitude are all signifcant in shrub, fern, and forb models. Signs of the parameters suggest fern and forb proportions of understory cover increasing moving to the north while the shrub proportion is expected to be higher near the coast and fern and forb proportions are expected to be higher near the Cascades, suggesting that climatic and soil gradients across the region impact vegetation.

Conclusion

Models presented here area a hierarchical set that can be used to predict vegetation cover and composition in young stands. Total vegetation cover is predicted using basal area, top height, site index and elevation. The resulting cover is used as input to the lifeform models, along with appropriate variables, to get cover of each life form in the understory vegetation community. Predicted cover can then be used for habitat and biodiversity assessments.

Developing models of young forest vegetation is ongoing work. Currently the most complete SMC vegation data is heavily weighted to young, open stands where the trees have not captured the site. Models presented here are best applied in these younger stands and extrapolation is not recommended. However, our work provides a frame work for refining these models. As the Type III installations age and t 1he number of measurements in older stands increases, models can be refit to better describe vegetation dynamics and provide better predictions as the stands develop.

Predicting vegetation cover for stands is only the beginning of what is possible with the SMC database. With time-series data from the installations, dynamic models predicting vegetation change based on the current forest conditions can be developed. Another aspect of our study is developing a set of these dynamic models to predict vegetation cover change with the resulting models doing a good job of predicting vegetation dynamics. These models can be used in parallel with forest growth models to predict future vegetation cover and composition in stands. Upcoming research following on these dynamic models is to develop models for the full young forest system that includes young trees along with the vegetation. This work is scheduled to begin in the spring of 2011. Keep checking the newsletters and SMC web site for updates on our research.

Figures

Figure 1: Predicted total cover (red dots) overlaid on measured data (gray dots)

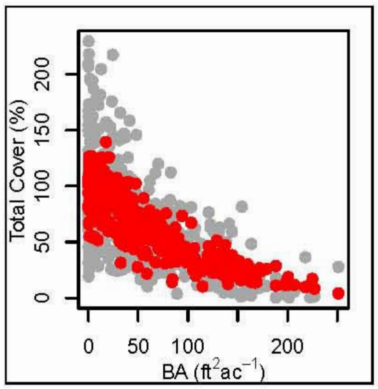


Figure 2: Predicted shrub cover (red dots) overlaid on measured data (gray dots)

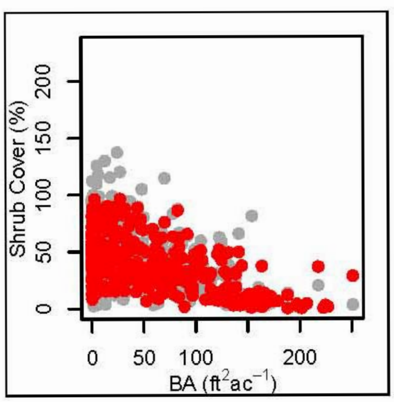


Figure 3: Predicted fern cover (red dots) overlaid on measured data (gray dots)

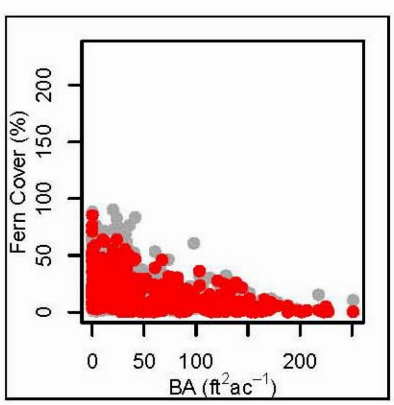


Figure 4: Predicted forb cover (red dots) overlaid on measured data (gray dots)

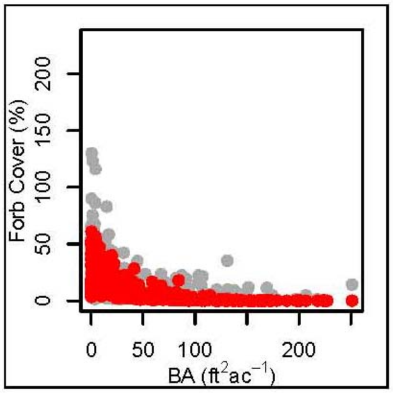
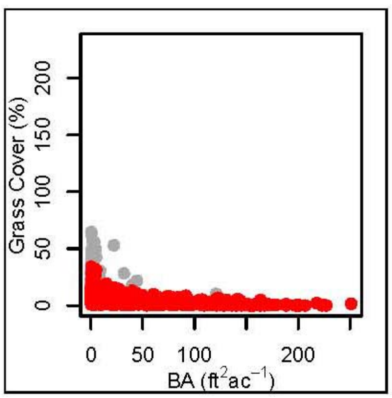


Figure 5: Predicted grass cover (red dots)overlaid on measured data (gray dots)



Abstracts and Publications

Kantavichai R., D.G. Briggs, and E.C. Turnblom. Effect of precommercial thinning followed by a fertilization regime on branch diameter in coastal United States Douglas-fir plantations. Can. J. For. Res. 38(6): 1564–1575 (2008).

Abstract

Marketing timber is shifting from logs, lumber, and veneer measured volumetrically to include carbon storage and energy that are based on dry mass. Conversion between volume and dry mass relies on accurate estimates of wood specific gravity (SG). We measured width and SG of growth rings and their earlywood and latewood components with X-ray densitometry on trees from controlled, thinned, biosolid fertilized, and combined treatments applied to a 55-year-old Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) stand. We developed models to predict interannual SG from climate and treatment effects and compared 20 year changes in dry mass and carbon storage with estimates from biomass equations and from the Wood Handbook average SG. Thinning increased latewood width but did not affect ring SG. Biosolid fertilization increased earlywood and latewood width and decreased ring SG 8% by decreasing earlywood SG, latewood SG, and latewood percentage. SG decreased with increased July soil moisture deficit; alternatively, SG increased with increased July total precipitation. Warmer mean March–May or August–November temperatures also increased SG. Because of the effects on SG, dry mass and carbon storage changes differed from volume changes produced by the treatments. Dry mass estimates using the average Wood Handbook SG or those calculated from biomass equations were inconsistent between treatments, with errors up to 50%.

Abstracts and Publications cont.

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

Abstract
Developing markets for carbon storage and bioenergy, shifting of the pulp and paper industry to biorefineries, and the potential of new technologies present the forest sector with exciting transformative opportunities and challenges. One of these challenges will be to understand the implications for fiber (wood) quality. This article provides a definitional context for fiber quality; examines traditional visual qualitative assessment methods and changes that are producing a shift toward methods to quantitatively measure properties; and briefly reviews the effects of age, silviculture, genetics, soil, climate, and location. With this background, the following four fiber quality research gap areas are identified: (1) poor understanding of the relationships between the properties of wood across various scales and their effect on product performance; (2) lack of understanding of how physiological processes, genetics, silviculture treatments, and growing environment conditions affect properties of wood at different scales; (3) the weak scientific infrastructure to address gaps 1 and 2; and (4) the lack of models that integrate fiber quality into decision support systems that can be used to improve planning of investment, silviculture, harvest, and marketing activities. To address these gaps, it is suggested that a lead organization be formed to define and set priorities, establish funding, and organize and oversee the research program.

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.

Abstract
Hybrid models offer the opportunity to improve future growth projections by combining advantages of both empirical and process-based modeling approaches. Hybrid models have been constructed in several regions and their performance relative to a purely empirical approach has varied. A hybrid model was constructed for intensively managed Douglas-fir plantations in the Pacific Northwest by embedding a hierarchy of components representing fundamental processes into a spatially implicit individual-tree model.

View and Print this Publication (673 KB)
http://www.treesearch.fs.fed.us/pubs/29692

Abstracts and Publications cont.

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:Issue 6,1085-1092.

Abstract

Because wood specific gravity (SG), also known as relative or basic density, is correlated with many physical and mechanical properties it is a widely used indicator of wood quality. Furthermore, because SG measures dry weight per unit green volume and dry wood contains about 49% carbon and 20 MJ/kg energy, SG is useful for converting tree volume to carbon and energy content equivalents. Although many studies have investigated variables affecting SG, few have developed models to predict SG at the local level from age, silvicultural treatment, and growing environment variables. This study developed a four-parameter logistic model with mixed effects to predict the specific gravity of annual growth rings (RSG) from forty six 76-year-old Douglas-fir (Pseudotsuga menziesii, Mirb. Franco) trees sampled from a thinning and biosolids fertilization experiment on a drought-prone site in Western Washington. RSG for up to sixty rings per tree was measured with X-ray densitometry on strips taken from disks removed from the top of the first 5 m log. Inter-annual RSG was modeled using treatment variables; local temperature, precipitation, and soil moisture deficit as growing environment variables; and ring number, area, width, and radius to the ring as tree variables. Ring age, ring area, March to May mean temperature, July soil moisture deficit, and whether or not biosolids had been applied were important predictors of RSG on this site. The equation for RSG can be easily converted to carbon or energy content equations by multiplying by the dry wood carbon and energy content factors.

Abstracts and Publications cont.

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.

Abstract
Knots on digital images of 51 full veneer sheets, obtained from nine peeler blocks crosscut from two 35-foot (10.7m) long logs and one 18-foot (5.5m) log from a single Douglas-fir tree, were detected using a two-phase algorithm. The algorithm was developed using one image, the Development Sheet, refined on five other images, the Training Sheets, and then applied to all remaining sheets. In phase one, global thresholding was used to segment the image through a series of morphological operations to isolate regions likely to contain knots. In phase two, adaptive thresholding was applied to grey scale and red component segmented images to improve the accuracy of the segmented knot. Overall performance, judged in terms of confusion matrix performance metrics, was better for the red component images. Red component recall (true positive) rate was 1.00, 0.99, and 0.96 for the Development, Training, and complete sets, respectively. For the grey scale images, recall rates were 0.96 for all sets. Red component accuracy was 0.76, 0.92, 0.73 (Development, Training, and complete) and those for the grey scale images were 0.71, 0.85, and 0.69, respectively. Red component precision also exceeded that of the grey scale (0.75, 0.93, 0.73 compared to 0.72, 0.88, 0.70). A greater percentage of knots (78%) segmented from red component images were correctly sized, while 16% had more pixels than required and 6% had fewer pixels. Comparative figures for the grey scale images were 57% correctly sized, 2% with more pixels, and 42% with less pixels. Based on our results, we will adopt the red component image for continuing work with digital veneer images from a sample of Douglas-fir trees selected on the basis of acoustic velocity measures. Together with acoustic measurements of the veneer sheets, we are investigating the extent that the number, size, and spatial arrangement of knots influences the average stiffness of veneer sheets, with a view to determining if a relationship exists between the average stiffness of veneer sheets in a peeler block, stiffness of the log, and stiffness of the parent tree from a range of silvicultural treatments.

Abstracts and Publications cont.

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.

Abstract
Growth models for coast Douglas-fir (*Pseudotsuga menziesii* var. *menziesii* [Mirb.] Franco) are generally based on measurements of stands that are genetically unimproved (or woods-run); therefore, they cannot be expected to accurately project the development of stands that originate from improved seedlots. In this report, we demonstrate how early expected gain and genetic-gain multipliers can be incorporated into growth projection, and we also summarize projected volume gains and other aspects of stand development under different levels of genetic gain, site productivity, and initial planting density. Representative tree lists that included three levels of productivity (site index = 100, 125, and 150 ft; base = 50 years) and three initial planting densities (302, 435, and 602 trees/ac) were projected from ages 10 to 60 years under three scenarios using two regional growth models (Stand Management Cooperative version of ORGANON and the Pacific Northwest variant of the Forest Vegetation Simulator). The two models projected similar percentage volume gains for improved seedlots. Seedlots with a genetic worth (GW) of 5% for height and diameter growth were projected to have volume gains of 3.3-5.8% over woods-run stands at 40 years and 2.1-3.2% at 60 years. Volume gains were projected to approximately double when GW was increased from 5 to 10%.

Abstracts and Publications cont.

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(11/12):37-47.

Abstract

Diversity in land management objectives has led to changes in the character of raw material available to the forest products industries in the US Pacific Northwest. Increasing numbers of logs from small-diameter trees, both plantation grown and those from suppressed or young stands, now constitute a large proportion of logs coming into the mill yard. Wood coming from plantations or young stands has different properties than wood coming from older, suppressed stands. This research examined wood properties of small-diameter plantation-grown Douglas-fir and western hemlock with the goal of a better understanding of utilization of small-diameter, fast-grown trees for use in manufacturing engineered wood composites. Twelve trees of each species were harvested and three bolts cut from each tree. Each bolt provided samples for X-ray densitometry profiles, compression, and tension parallel to grain and flexure tests. Both species were found to have a very high proportion of juvenile wood. Most wood properties decreased with increasing vertical position and increased with increasing distance from pith for both species. Increased competition for wood fiber, which accounts for as much as 25 to 35 percent of total wood composite (such as particleboard, medium-density fiberboard and oriented strand board) manufacturing costs, necessitates an understanding of raw material properties and their variations. This knowledge could assist in optimizing the manufacturing process and maximizing efficiency of wood raw material use, thus increasing profits.

Upcoming Meetings and Events

August 24-26, 2010 Joint meeting of: Western Forest & Conservation Nursery Association and Forest Nursery Association of British Columbia. Sheraton Portland Airport Hotel, Portland, OR. http://www.westernforestry.org/target_seedling/target_seedling.htm

September 21-22, 2010 SMC Anual Fall Meeting, Oregon State University, Corvallis, OR. http://www.cfr.washington.edu/research.smc/pages/events.html

Stand Management Cooperative, School of Forest Resources
University of Washington, Box 352100 Seattle, WA 98195