From the Director

The fall meeting was held at the Little Creek Casino Hotel near Shelton WA.; with 40 persons from 21 organizations attending. Policy Committee Chair Mike Mosman opened the meeting and commented on the work of the Finance Committee since the spring meeting to assess the budget effects of the genetic-gain-trial/type IV (GGTIV) installations and proposed new modeling projects. He then turned the meeting over to Director David Briggs. The following are highlights of the meeting.

**Young stand model proposal:** At the spring meeting the Policy Committee voted to commit 20% matching funds to a 3-year proposal by Martin Ritchie and Greg Johnson titled “Young Stand Simulator for Douglas-fir in Western Oregon and Washington” that is now in the final review of the USFS PSW-AF&PA collaboration. This project will use data from the SMC Type I and III installations to develop a model for the first 15 years of stand development that will then export to existing growth and yield models that pick up from approximately that stage.

**ORGANON equation update proposal:** The Policy Committee voted to fund a proposal from Dave Hann titled “Re-analysis of the Diameter Growth Rate and Height Growth Rate Equations in SMC ORGANON”. This would complement the young stand model proposal. At the time SMC ORGANON was developed, very little data was available from the SMC installations. Data collected on these installations over the past 15-20 years can be used to re-analyze the original equations.

**Budget Recommendation and Vote:** The SMC Finance Committee recommended that the SMC implement a 5% dues increase in 2006. This is the first time dues have been changed since 1997. Inflation, general consolidation of the industry, and the commitments to the modeling and GGTIV projects created a situation where a dues increase was necessary.
In This Issue

In addition to an article on understory vegetation development trends and patterns based on Mark Senger’s Masters thesis, you will find an update on work by John Haukaas, SMC Programmer, to develop a user-friendly interface for the tree-list generator that was produced by Kevin Gerhinger. There is also a brief description of a project by Eric Sucre who is working with Rob Harrison and Eric Turnblom to better understand why some stands respond to nitrogen fertilization and others do not.

SMC 20th Anniversary Celebration

2005 will mark the 20th year since the SMC formed. A planning committee consisting of Norm Andersen, David Briggs, Bob Curtis, Randall Greggs, Dave Hyink, and Mike Mosman has been formed to develop plans for a 20th Anniversary celebration. We have reserved September 20-21, at Pack Forest for the fall meeting, celebration program and field trip. We will keep you informed in future issues.

Fall Meeting Field Tour

The field tour first visited the set of three installations at Brittain Creek, north of Hoquiam. Three Type III installations were planted at the same time at Brittain Creek, pure Douglas-fir, pure western hemlock, and a 50-50 mixture all planted at the same 6 planting spacings. When the group arrived, Peter Carter from Fiber-Gen in New Zealand demonstrated tools for non-destructively testing logs with the MH 200 and standing trees with the ST 300 for acoustic measures related to stiffness properties of lumber and veneer that can be recovered. Dave Briggs has a proposal to the PNWRS-AF&PA to acquire both of these units and conduct research to develop baseline relationships between these units and lumber and veneer stiffness and to test for influences of genetics and cultural treatments. After the demonstrations, Eric Turnblom reviewed the results of Mariano Amoroso’s comparison of early development of these pure vs mixed installations and the results of Mark Senger’s analysis of understory vegetation trends as affected by planting spacing. The group then traveled to the first GGTIV installation at Donkey Creek Installation which has pin-flagged plots, to discuss the layout, remaining set-up procedures, and future measurement procedures. After Donkey Creek those participating in the GGTIV site selection committee headed to inspect a site on Quinault land.
External Research Grants

New research funding includes $40,000 from NCASI to Rob Harrison for continued work on the long term site productivity study at Fall River; continued work on a $30,000 contract to develop a database for red alder that will support a future alder modeling effort, and receipt of a $100,000 grant from the USFS to build a database system for the national network of 62 long term site productivity (LTSP) studies. D. Briggs, R. Harrison, and E. Turnblom also have 4 proposals in the final review for the PNWRS-AF&FA collaboration. Just as this issue went to press we learned that 2 of these proposals have been funded.

Completed Graduate Student Theses

Mariano Amoroso finished his Masters thesis with Eric Turnblom and copies of SMC Working Paper No. 3 “Growth and Yield of Douglas-fir & Western Hemlock in Pure and Mixed Planted Stands: Results at Age 12 from the SMC Type III Trials” are available for downloading from the SMC website. A brief summary of this research appeared in the previous issue of the newsletter. Mariano has now started on a PhD program at the University of British Columbia.

Mark Senger finished his Masters thesis “The Effect of Tree Density on Understory Vegetation: 14-Year Results from Douglas-fir Plantations” with Eric Turnblom. This is the first look at trends emerging from the understory vegetation surveys on the Type III installations. A brief summary is included in this issue and future publications from Mark’s thesis are in an early stage of development. Mark is now working for the U.S. Forest Service in northern California.

Christopher Licata finished his thesis “Nitrogen mineralization in a coastal Washington Douglas-fir plantation under two levels of logging slash and coarse woody debris retention with Rob Harrison and they have a journal paper to be submitted to the Western Journal of Applied Forestry titled “Predicting the Biomass of a High Productivity Even-age Douglas-fir/Western Hemlock Plantation in the Pacific Northwest: Accounting for Bias Introduced From using Generalized Predictive Equations.”

Genetic Gain Trial/Type IV Installations

Four sites in the Grays Harbor breeding zone have been accepted for this collaboration between the SMC and NWTIC. See the previous newsletter for the basic design of these installations. Three of these installations will be planted in 2005 and one will be held over for the 2006 planting. This leaves us needing to find 2 more sites for the 2006 planting. Since only one of the currently accepted sites is in the southern half of the Grays Harbor breeding zone we hope that landowners in that part of the breeding zone will offer candidates for evaluation. If you have possibilities please contact Eric Turnblom. The SMC field crew has installed plots on 3 of the 4 selected sites, one has been pin-flagged for planting, and contractors will complete pin-flagging the others, site preparation spraying, and fencing this fall.

After finishing my Master’s degree in the winter of 2004 and working at the University of Washington for 6 months, I moved to the University of British Columbia (Canada) in September to pursue a PhD in silviculture. In addition to my class work, I am currently working on a project designed to examine mixed stands grown at high densities for the production of high value wood. My near term plans include starting to write my dissertation proposal so I can apply for funding to begin my field work in Argentina, as well as finishing the publication of research articles with Dr. Turnblom on research done for the SMC during the last year.
Fertilization Workshops

At the joint TAC meeting on fertilization on April 1, a suggestion was made that UW, OSU, and U-Idaho examine the possibility of developing a series of one-day workshops for operational personnel on various aspects of fertilization issues. David Briggs (UW), Leonard Johnson (U-Idaho), Doug Maguire (OSU) have initiated discussions as to timing, format, and content of such a series of workshops. The concept would be to develop a series of 1-day workshops that could be offered at different locations and times for the convenience of operational personnel. Each workshop would have a mix of lecture and field activities. If you have topics that you would like considered for these workshops please contact Dave (dbriggs@u.washington.edu), Leonard (ljohnson@uidaho.edu), or Doug (doug.maguire@orst.edu).

Tree List Generator User Interface

John Haukaas, SMC Database Specialist, University of Washington

The “Tree List Generation Database System” was developed by Kevin R. Gehringer and Eric C. Turnblom (August 2000) in response to the need to generate “reasonable” tree lists for input to individual tree based models, when only stand level descriptors are available (e.g., site index, age, stems per acre, etc.). The system is comprehensive and moderately complex. It involves many computer programs for creation and maintenance of tree list generation databases and creation of tree lists. It is documented in the “Tree List Generation Database User’s Guide and Reference Manual”. To get up and running requires hours of study and also the knowledge of MS-DOS, and so there was a need for an easy-to-use Windows user interface for generating tree lists. The “Tree List Generator User Interface” (TLGUI) was developed for this purpose.

TLGUI displays an entry form for the user to specify the type of tree list desired. Either imperial or metric units can be used. Stand qualifiers that can be entered include: stand origin, stand type, site index, total age, QMD, stand density. Thinning may also be specified via several qualifiers. Also a number of processing options are available. The resulting tree list’s units can be specified as either imperial or metric.

TLGUI checks the user input for completeness and correctness, and then creates the necessary files to access the “Tree List Generation Database System” to generate the desired tree list. After the tree list is generated, the entry form is re-displayed for further tree list requests.

TLGUI does not provide access to the database creation and maintenance capabilities of the “Tree List Generation Database System”. TLGUI uses the initial tree list generation database: tgdb1r00, created from the SMC database using the database creation and maintenance capabilities. Tree list generation database, tgdb1r00, is described in the User’s Guide and Reference Manual.

TLGUI is currently in its testing phase and should be ready for distribution at the 2005 SMC spring meeting. If you would like to help in the testing phase, please let us know. We welcome any comments and suggestions. John Haukaas: jhaukaas@u.washington.edu.
The Use of Soil Chemical and Physical Properties to Help Predict the Response of Douglas-fir to Nitrogen Fertilization

Eric Sucre, MSc.
University of Washington

During the summer of 2004, soil samples were collected from 9 fertilized Douglas-fir [ *Pseudotsuga menziesii* (Mirb) Franco] SMC Type 1 installations. Samples from the forest floor and 3 depths of mineral soil (0-15cm, 15-30cm, and 30-50cm) were collected in 6 plots per installation following the SMC soil and forest floor nutrient sampling protocol. The samples were collected from plots with the initial spacing levels of ISPA, ISPA/2, and ISPA/4, with and without fertilization regimes. At each installation a descriptive soil profile was conducted to better understand the soil and to classify the soil to the subgroup level. Along with site climatic data, soil physical and chemical properties such as bulk density (Db), pH, C/N ratio, cation exchange capacity (CEC), available nitrogen (NO₃⁻ and NH₄⁺) and available phosphorus will be regressed against the response variable (relative difference in volume growth between fertilized and control plots.)

My Master’s Thesis project will examine the data from 6 of the 9 fertilized SMC Type 1 installations (3 from Oregon and 3 from Washington) for this study. The data will be stratified by thinning level, site quality, soil suborder, and geographic location. The purpose of this study is to better understand why some stands respond to nitrogen fertilization and others do not.

There are several long-term objectives for the SMC Type 1 data collected, under the direction of Dr. Eric Turnblom. The data from all 9 of the fertilized SMC Type 1 installations will be used to help validate the NRCS (Natural Resources Conservation Service) soil survey map information by comparing the information from SMC research sites to what is described by the NRCS. This will eventually include more than just the SMC Type 1 sites containing plots that have been fertilized. Secondly, updating the SMC TreeLab model by using the NRCS soil survey map information or data obtained from SMC sites, whichever is better, to refine/replace Site Index as a predictor variable in SMC TreeLab. Finally, comparing outputs from the 3-PG model to the newly updated and enhanced TreeLab model to see which best satisfies management goals.
Biological Diversity in a Douglas-fir spacing trial after 14 years

Eric C. Turnblom. University of Washington, Associate Professor, and SMC Silviculture Project Leader

Mark Senger. MS, University of Washington

Dave Briggs. University of Washington, Professor, and SMC Director

The concept of diversity can be applied to, and has been developed for each level of ecological organization, which can be thought of as different spatial scales. At the landscape level, attributes such as the identity, distribution, and proportion of different habitat types can be monitored. At the ecosystem level, richness, evenness, and diversity of species, guilds, and communities can be important. At the species level, abundance, density, and biomass of each population may be important. At the genetic level, genetic diversity of individual organisms within a population is important. It is important to assess and interpret biodiversity across all these levels.

The objective of this study was to examine the relationship between tree density and the composition and diversity of understory vegetation following the establishment of Douglas-fir plantations. It was expected that the trends in measures of diversity observed in previous studies following timber harvest would be evident, but the timing and magnitude of the changes in understory vegetation would vary with tree density. Negative correlations for measures of understory vegetation with the amount of canopy cover in older stands suggest that earlier canopy closure for stands established at higher tree densities may accelerate previously observed trends in the abundance and diversity of understory vegetation or the dominance patterns of lifeforms. Similarly, lower tree density may result in a greater abundance or diversity of understory vegetation for a longer period of stand development, or some intermediate level of tree density may produce the largest response in measures of understory vegetation (i.e., an “optimum” tree density). To assess whether tree density affected previously observed trends for understory vegetation early on in stand development, this study utilized repeated measurements of understory vegetation from plots established at widely differing tree densities, ranging from 100 Trees Per Acre (TPA) up to almost 1200 TPA, known as the SMC Type III installations (Maguire, et al. 1991).

When using forest stands as the basis for assessment, the ecosystem level, or within habitat scale is the applicable scale at which to measure diversity (a.k.a. alpha diversity).

The simplest expression of diversity is the number of species per unit area, $n$, also known as Species Richness, $S$.

$$S = n$$

However, numerous diversity indices have been developed which incorporate both the number and relative abundances of species. Differences between diversity indices are largely a result of assumptions about the distribution of the underlying data, and how richness (number) and the relative abundance (evenness) of species are weighted in the calculations.

One commonly used alpha-diversity metric is the Shannon Index ($H'$), given by

$$H' = -\sum_{i=1}^{R} p_i \ln(p_i),$$

where
\( p_i \) denotes the proportional contribution of the \( i^{th} \) species in each plot (species composition), and \( \ln \) denotes natural logarithm.

We see in Exhibit 1, that values for Shannon’s index are declining with increasing age in these young stands, indicating a general decline in biodiversity. It was postulated that patterns in the development of understory vegetation (represented by the diversity measures chosen for this study) would be accelerated with increasing tree density. Trends seen in Exhibit 1 generally bear this out, and larger; more significant differences will most likely be seen in the near future.

Another commonly used alpha-diversity metric is the Reciprocal of Simpson’s Index \( (N_2) \), given by

\[
N_2 = \frac{1}{\sum_{i=1}^{n} p_i^2}
\]

where

\( p_i \) denotes the proportional contribution of the \( i^{th} \) species in each plot, as before.

Exhibit 2 shows a general decline in the reciprocal of Simpson’s Index, corroborating what we found in the graph for Shannon’s index. However, differences between spacings are not yet significantly different, but trends indicate differences are increasing with time. However,

this index seems to show biodiversity is leveling off in the less dense plots.

The mathematical structure of the two Indexes themselves, as well as other empirical research reveals that Shannon’s Index is more affected by richness, whereas the reciprocal of Simpson’s Index is more affected by evenness (or lack thereof).

**Lifeform Responses to Spacing**

Assessing trends in various guilds, or lifeforms, over time is also important. The understory lifeforms we recognized were shrub, fern, forb,
and graminoid. Shrubs include woody, usually multi-stemmed, erect or trailing perennial species.

Ferns include all fern species together (some studies separate bracken and sword). Forbs include all herbaceous (non-woody) species except ferns and graminoids. Graminoids include the grasses, sedges, and rushes.

General trends observed by lifeform can be summarized as increasing proportions of fern and shrub cover and declining proportions of herb, forb, and graminoid cover. While response curves displayed some differences for shrubs, ferns, and graminoids as a result of tree spacing, they were not statistically significant by the end of the study period.

Herbs in total (the sum of fern, forb, and graminoid lifeform categories) decreased over the entire study period.

Discussion
The response curves for the diversity measures provide general trends over time rather than exact prediction at a specific age. The methods used in constructing the curves removed the variation between installations to reveal general trends applicable to multiple locations and understory vegetation communities. We found large variations in observed values for each diversity measure between installations, and fluctuation in values over time within an installation. In order to predict values at a specific age for any of the measured response variables, more detailed site attributes, including extrinsic factors such as weather would be required.

With more repeated measurements or replications, it is likely that the differences in observed trends will become more significant with time.
Although not reported here (see Senger 2004, for more detail), differences in crown cover between spacings were evident by about ten years after tree planting in these Douglas-fir plantations. We therefore expect that different crown densities of different tree species may effect understory vegetation composition and diversity.

Treatments such as pruning that reduce the crown of individual trees will impact total crown cover, which warrants further investigation if intensive management is needed to reach a desired objective, either for specific habitat conditions or otherwise.

Species-specific research is needed to determine the causes of the observed trends.

Conclusions

- Patterns in understory vegetation seen in previous research are corroborated
- Trends in response curves (H', N₂, Shrubs, Forbs, Ferns, Graminoids) indicate that tree density affects understory vegetation at young ages
- Two measures of understory diversity show declining trends after 14 years, with shrub and fern components increasing as forbs and graminoids decrease

References


Abstracts and Publications

Stephen E. Reutebuch, Constance A. Harrington, David D. Marshall and Leslie C. Brodie. Use of Large-scale Silvicultural Studies to Evaluate Management Options in Pacific Northwest Forests of the United States. Forest Snow Landscape Research. 78, 1/2: 191–208 (2004). U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 3625-93rd Avenue SW, Olympia,WA 98512, USA. srutebuch@fs.fed.us, charrington@fs.fed.us, dmarshall@fs.fed.us, lbrodie@fs.fed.us.

Abstract
A suite of large-scale silvicultural experiments has been established to develop and assess operational silviculture options for the Pacific Northwest Douglas-fir (Pseudotsuga menziesii [Mirb.] Franco var. menziesii) forests. This paper summarizes three such studies that focus on three major stages in the life of managed stands – early development, midrotation, and regeneration harvest. Development of silvicultural treatments that are needed to restore and maintain Oregon white oak (Quercus garryana Dougl. ex Hook.) within mixed-species stands in western Oregon and Washington are also presented. In addition to responses of overstory trees and understory plants to silvicultural treatments, several other aspects, such as coarse woody debris retention, residual stand damage, soil disturbance, economics, and public acceptance of treatments, are also being investigated in one or more of the studies. Advantages, special considerations, and challenges of conducting large-scale, operational silviculture research studies are discussed.


Abstract
Existing log grading procedures in the United States make only visual assessments of log quality. These procedures do not incorporate estimates of the modulus of elasticity (MOE) of logs. It is questionable whether the visual grading procedures currently used for logs adequately assess the potential quality of structural products manufactured from them, especially those for which MOE is of primary concern. The purpose of this study was to investigate the use of stress wave nondestructive evaluation techniques to sort red maple logs for the potential quality of lumber obtained from them. Ninety-five red maple logs were nondestructively evaluated using longitudinal stress wave techniques and sorted into four stress wave grades. The logs were then sawn into cants and lumber. The same procedure was used to obtain stress wave times in the cants and lumber. The lumber specimens were then dried and graded using a transverse vibration technique. The results of this study showed that good relationships existed between stress wave times measured in logs, cants, and the lumber produced from the logs. It was found that log stress wave grades have positive relationships with the lumber grades. Logs with high stress wave grades produced high-grade lumber. These findings indicate that the longitudinal stress wave technique has potential in sorting logs and cants for the production of high MOE products.


Abstract
Wood stiffness varies enormously both within and between trees, so it is inevitable that low-grade solid wood products are produced from some trees. Accordingly, it would be highly desirable to segregate logs to ensure that only those logs with predominantly high stiffness wood are processed.
into structural lumber products. This study examined whether sound flight velocity (m s–1) could be used as a direct measure of wood stiffness to allow such segregation. Trees of radiata pine were measured before and after harvest with a non-destructive acoustic device (stress wave timer) to see if there was a relationship between sound wave velocity in either standing trees or logs and machine stress-grades of boards derived from those trees and logs. The speed of sound along logs was sufficiently closely correlated with wood stiffness to allow logs to be sorted into classes. A highly significant and positive relationship was found for acoustic measurements made in logs and a weaker, but still significant, relationship existed for acoustic measurements made in standing trees. Such segregation of logs according to wave velocity measured in the field may save a large sawmill between $1–4m each year. Acoustic methods may also be used as an indirect tool for selection provided the heritability of the measurements is high enough and there is significant genetic correlation with genetic values for wood stiffness. From another experiment we have estimated the heritability of several acoustic measures and hope to be able to estimate genetic relationships with wood quality soon.

Upcoming Meetings and Events

November 16, 2004 – Swiss Needle Cast Conference, Co-sponsored: Swiss Needle Cast Cooperative. Hilton Hotel in Eugene, Oregon. For more information call the OSU College of Forestry Outreach Education Office at 541-737-2329, or e-mail your questions to: forestry.outreach.education@oregonstate.edu.

December 1, 2004 – Alternative Species Silviculture or When Douglas-fir Isn’t the Answer. Red Lion Hotel, Eugene, OR. For more information visit: http://westernforestry.org.


February 22-23, 2005 – New Zealand Douglas-fir Cooperative Meeting. Rotorua, NZ. For more information contact Leith Knowles: leith.knowles@forestresearch.co.nz.

