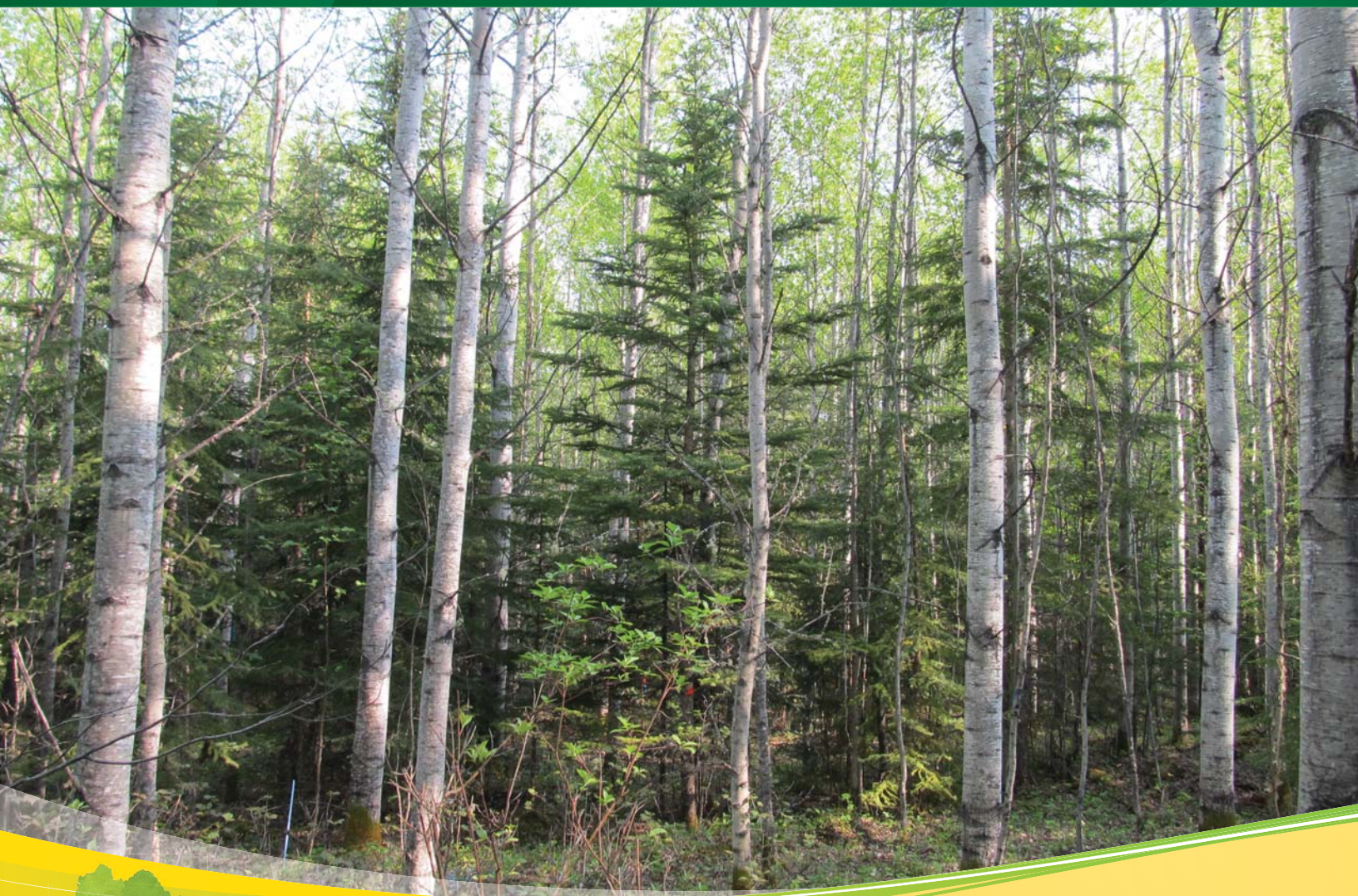
Western Boreal Growth and Yield Association

Annual Report 2014

Forest growth, yield, inventory and planning in western Canada



WESBOGY

www.WESBOGY.ualberta.ca

UNIVERSITY OF ALBERTA

CONTENTS

Executive Summary and Highlights

2013 marked the 29th annual fall meeting for the Western Boreal Growth and Yield Association and marked the 23nd year of measurement for the oldest of the WESBOGY Long-term study sites. Members of the association continue to collaborate on development and dissemination of growth and yield modeling technology and information for western boreal and montane forests. We work to support research, development and extension activities and support data sharing relating to growth and yield.

Current membership in the association includes seven forest companies, three provincial/territorial governments (Alberta, Saskatchewan and the Northwest Territories) and the federal government.

Work has continued on development of the Mixedwood Growth Model. A new stand alone version of MGM is now in a testing stage. The new version offers greater speed and better interaction with other programming languages improving it's utility in forest management planning. The approval process for MGM continued with the vetting of the MGM documentation and an expandeded dataset for validation. MGM development has also seen singnificant progress in the its ability to model jack pine growth and mortality. MGM is now being used for several projects in the ALPAC and Martin Hills FMA.

In 2013 Kirk Johnson (M.Sc. student) completed the compilation of his data for his study examining the effects of establishment practices on dynamics of white spruce plantation in Saskatchewan. We anticipate that Kirk will complete data analysis and his thesis in late 2014.

Dan Jensen (M.Sc. student) and Mike Bokalo have made substantial progress on their study examining the use of LiDAR to measure gap area in stands and impacts of gaps on stand level yields. This study will also be completed in 2014.

Gabriel Oltean (M.Sc. student) is looking at the precision prediction of site index and future yield using wet areas mapping and full feature LiDAR.

Ivan Bjelanovic (M.Sc. student) started his project in 2013. It is a case study using the 1968 Marten Hills Fire to determine if the prediction of future forest productivity can be enhanced using Full Feature LiDAR, Wet Areas Mapping and Landform.

Phil Comeau started a project titled, "The stand dynamics following canopy removal and release of advance regeneration in aspen and lodgepole pine dominated stands". This project addresses the need for a better understading of understory stand dynamics following both understory protection harvesting and post mountain pine beetle understory growth.

Several other studies and initiatives are underway or under development that will contribute to a better understanding of effects of management practices on growth and yield of western boreal forests.

This Annual Report presents highlights of work accomplished during 2013 and outlines major activities planned for 2014.

The purpose of the WESBOGY Association is to conduct research projects that contribute to the development and dissemination of growth and yield information and modeling technology for both natural and regenerated stands growing in the boreal mixedwood region, primarily aspen and spruce.

Individual projects and/or students sponsored with Association resources should make progress in achieving this mission. Sponsored projects include those supported using Association resources. Associated projects are identified with the Association but are funded by individual (or groups of) Members or other sources. Business plans outlining project priorities and the allocation of resources to accomplish the mission are developed and periodically reviewed with the participation of Steering Committee Members.

GOALS

To develop and implement a program of research in the study of growth and yield and stand dynamics focused on problems of interest to Members of the Association. Projects will have defined goals and products, and will be completed in a timely manner.

To increase knowledge and awareness of growth and yield relationships, as they exist in western and northern Canada.

To foster communication, cooperation and exchange of information among the Members as well as various agencies and groups concerned with management and development of boreal forests.

To focus on the dynamics of mixedwood stands of aspen and white spruce growing in the boreal forest. Basic relations to be studied will include establishment, ingrowth, growth, and mortality. While the major species of interest are aspen and white spruce, other species such as balsam poplar, lodgepole pine, black spruce, and jack pine will also be studied. In developing simulation models based on these relations, provision will be made for projecting stands subject to multiple interventions (treatments) through the life of the stand. Differences between Natural Subregions (Ecoregions) and sites will also be evaluated where there is sufficient data.

To encourage the establishment and continued monitoring of standardized permanent sample plots (PSPs) to quantify the effects of forest management practices in natural and regenerated stands, and in general to coordinate the acquisition of high priority growth and yield data;

To identify, evaluate, rank and address areas of research which are: of regional importance, of shared mutual interest, and most effectively approached cooperatively by the Association rather than by individual efforts;

To facilitate the dissemination of growth and yield data through the development of appropriate procedures, standards and databases for Members' use.

5-Year Objectives

The following table lists measurable objectives identified for the 2011-2015 Agreement. It also includes links to the overall goals of the WESBOGY Association.

5 – year Objectives	Related Goals
1. To maintain the WESBOGY long-term study designed to evaluate the effect of spruce and aspen density levels on the development of plantations from establishment to final harvest. Maintain and update the database for the WESBOGY long-term study. Complete analysis of data. Encourage new Members to participate in the long-term study.	Goal #1 and #5
2. To develop and refine growth and mortality relationships and incorporate these new relationships into the MGM growth simulator.	Goal #1 and #2
3. To expand the scope of the MGM growth simulator as a tool for the development of managed stand yield projections for the major commercial tree species in the region. This will also include providing support for studies required to develop models of tree and stand response to establishment, tending and harvesting practices.	Goal #4, #5, and #6
4. To maintain a website that will identify, evaluate and disseminate information on trends in growth and yield research	Goal #3 and #7
5. To hold annual technical meetings for dissemination of information obtained from ongoing Sponsored Research Projects as well as other speakers invited to address other relevant growth and yield issues	Goal #3 and #7
6. To expand the scope of WESBOGY activities by recruiting new Members and seeking opportunities to augment the research component by securing funding from other granting agencies.	Goal #1, #2, #3 and #6
7. To identify and summarize regional PSP database standards and protocols for data exchange and use with regional growth models.	Goal #2, #3, #5 and #7
8. To collaborate with other agencies and organizations in the development of research and acquisition of data to support a better understanding of and development of models to estimate effects of silviculture on yield.	Goal #1, #2, #3 and #4
9. To identify and prioritize research needs and to initiate new projects as appropriate under the direction of the Steering Committee and Members.	Goal #1, #2 and #6

1. To continue analysis of the WESBOGY long-term study including:
   - Height, diameter, and density patterns for aspen in the natural plots;
   - Height and diameter growth of spruce and aspen in treated plots;
   - Mortality of spruce and aspen;
   - Recruitment (ingress) of new trees into natural and treated plots;
   - Preparation of manuals, reports, papers, extension notes and posters for distribution to Members and for journal publication;
2. To continue development of MGM to improve its ability to represent stand responses to silviculture. This will include:
   - Refinement of mortality, breakup and self-thinning functions for aspen;
   - Evaluation of model sensitivity to site index;
   - Natural regeneration and ingress of white spruce and aspen;
   - Refine calibration for lodgepole pine;
   - Calibrate MGM for black spruce, jack pine and balsam poplar;
   - Model Validation and publication of results;
   - Demonstration and training.
3. To update and maintain the WESBOGY long-term study data collection manual, the database, and the WESBOGY website and sharepoint site.
4. To seek to expand the scope of WESBOGY activities and influence.
   - To identify and approach potential new Members;
   - To seek opportunities and develop proposals for potential complementary funding from other agencies.
   - To work with other groups and co-operatives and to promote WESBOGY activities and information in growth modeling, silviculture practices and forest management activities.
5. To organize the WESBOGY Fall, Spring, and Steering Committee meetings each year. Prepare the meeting minutes and WESBOGY annual reports.
6. To review and update the list of priority and ongoing projects.
7. To undertake high priority Sponsored Research Projects as recommended by the Steering Committee and approved by the Members.
8. To work with Members in the development of proposals for high priority associated research projects.

Current Research Projects

WESBOGY Long Term Study	
Maintenance of Long Term Study Data	**Status:** Long Term - Ongoing **Researchers:** Mike Bokalo, Phil Comeau, Susan Humphries
Analysis of Long Term Study Data	**Status**: Analysis of data received through 2012 completed for all installations over 10 years old and summarized in Annual Report. Analysis of all data planned for early 2014. **Researchers**: Mike Bokalo, Phil Comeau, Susan Humphries
Siphon Creek and Bear Mountain	**Status**: These two studies examining effects of aspen density manipulations on spruce and aspen growth were established by the BC Ministry of Forests, Lands and Natural Resource Operations in 1990. Data were recently collected (2011), stored in the LTS database and are being analyzed (2013-2014). Publication of results in a journal article is planned. **Researchers**: Richard Kabzems Mike Bokalo, Phil Comeau, Dan MacIsaac and Susan Humphries
MGM Development	
Validation of MGM2010A with independent PYGI dataset	**Status**: Data Recieved in Feb 2014, compilation and validation underway. **Researchers**: Mike Bokalo, Ken Stadt, Phil Comeau, and Steve Titus
MGM Height, Diameter and Mortality Functions for jack pine	**Status**: Initiated in late 2012 with funding from Saskatchewan Environment. Growth and mortality functions have been developed and are being implemented and tested in MGM. Project will be completed by March 2015. Funding by Sask Government, Alberta ASRD and ALPAC. **Researchers**: Mike Bokalo and Phil Comeau
Conversion of MGM to Visual Basic Stand Alone	**Status**: Initiated in 2012 and currently underway. Alpha version now available. **Researchers**: Mike Bokalo and Steve Titus
Associated Research Projects	
Stand Density Index and its relationships with productivity and understory vegetation	**Status**: Initiated in 2007; one paper published in 2012; PhD thesis completed in 2014. **Researchers**: Valentin Reyes-Hernandes (PhD student) and Phil Comeau
Influence of silviculture on the successional dynamics of mixedwood stands	**Status**: Initiated in 2011 with funding from Saskatchewan Environment. Data analysis and thesis preparation is underway with completion expected in 2014. **Researchers**: Kirk Johnson (M.Sc. student), Phil Comeau and Mike Bokalo
The use of LiDAR and Wet Areas Mapping in representing Stand Structure and Unproductive Gaps in Forest Stands	**Status**: Initiated in 2011; field work completed in 2012 and 2013. Data analysis and thesis preparation underway. **Researchers**: Dan Jensen (M.Sc. student), Mike Bokalo, Phil Comeau and Barry White
Benchmarking Natural (fire origin) stand regeneration	**Status**: Manuscript published in New Forests **Researchers**: Stefanie Gaertner, Mike Bokalo, Ken Stadt and Ellen Macdonald
High precision prediction of site index and future yield by use of wet areas mapping and full feature LiDAR	**Status**: Initiated in 2012; data acquired 2012 and 2013; field data collection to be completed during 2013. Thesis and Manuscript in 2014. **Researchers**: Gabriel Oltean (M.Sc. student), Phil Comeau, Mike Bokalo, and Barry White
Prediction of future forest productivity and silvicultural challenges using Full Feature LiDAR, Wet Areas Mapping and Landform: A case study using the 1968 Marten Hills Fire	**Status**: Initiated in 2014. **Researchers**: Ivan Bjelanovic (M.Sc. student), Phil Comeau, Mike Bokalo, John Nash and Barry White
Stand dynamics following canopy removal and release of advance regeneration in aspen and lodgepole pine dominated stands	**Status**: Initiated in 2014. **Researchers**: Valerie Krebs (M.Sc. student), Phil Comeau, Mike Bokalo, Greg Behuniak (Weyerhaeuser), Vic Lieffers, Ellen Macdonald, Gitte Grover (ALPAC), Ken Stadt (AESRD), Dan MacIsaac (CWFC), Derek Sidders (CWFC).

Membership

Agency/Company	Current Membership
Alberta Sustainable Resource Development	Since 1985
Alberta-Pacific Forest Industries Inc.	Since 1990
Alberta Plywood	Since 1985
British Columbia Ministry of Forests	1985-2003
Canadian Forest Products	Since 1985
Daishowa-Marubeni International Ltd.	Since 1990
Wood Fibre Centre, Canadian Forest Service	Since 2009
Louisiana-Pacific Canada Ltd., British Columbia	Since 1997
Louisiana-Pacific Canada Ltd., Manitoba	Since 1996
Manning Diversified Forest Producs Ltd.	Since 1997
Northwest Territories Resources, Wildlife and Economic Development	Since 1985
Saskatchewan Ministry of Environment	Since 1985
University of Alberta	Since 1985
Weyerhaeuser Company, Alberta Forestlands	Since 1985

Steering Committee Members

A Steering Committee, consisting of three or four members elected to the Committee at the Annual Fall meeting, and the Chair and the Research Scientist sets policy, develops strategic objectives and priorities, reviews work plans, adjusts annual membership assessments in light of planned activities, and deals with other items which may arise.

2000 Titus, Wang, Behuniak, Niemi, Weeks
2001 Titus, Behuniak, Niemi, Nichol, Ewan
2002 Titus, Bokalo, Comeau, Behuniak, Niemi, Nichol, Ewan
2003 Comeau, Bokalo, Titus, Behuniak, Niemi, Nichol, Ewan/Ashley
2004 Comeau, Bokalo, Titus, Behuniak, Nichol, Ashley, Whittaker
2005 Comeau, Bokalo, Titus, Behuniak, Nichol, Ashley, Whittaker
2006 Comeau, Bokalo, Behuniak, Nichol, Blue/Ashley, Whittaker/Whitmore
2007 Comeau, Bokalo, Nichol, Ashley, Whitmore, Morgan
2008 Comeau, Bokalo, Leblanc, Zaichkowsky, Whitmore, Morgan
2009 Comeau, Bokalo, Leblanc, Whitmore, Morgan
2010 Comeau, Bokalo, Leblanc, Whitmore, Morgan, Blue
2011 Comeau, Bokalo, Leblanc, Whitmore, Morgan, Blue
2012 Comeau, Bokalo, Leblanc, Whitmore, Blue
2013 Comeau, Bokalo, Leblanc, Whitmore, Blue

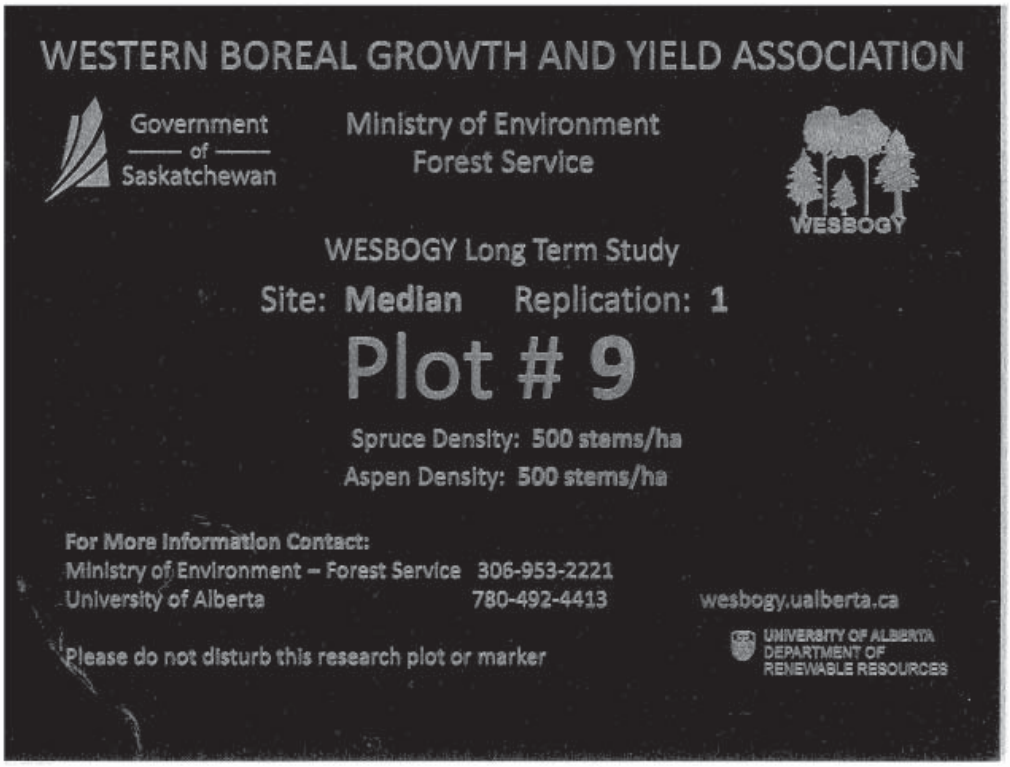
Long Term Study of Aspen/Spruce Stand Development

Mike Bokalo, Phil Comeau and Susan Humphries

The WESBOGY Long Term Study is designed to advance our understanding of the dynamics of mixedwood stands following tending. The study, initiated in 1990, involved planting white spruce seedlings in recently clearcut areas where aspen regeneration had already been established. For the first 5 years, vegetation was controlled by clipping or using plastic mulch mats within a 40 to 50 cm radius of the spruce to minimize early spruce mortality. After a 5 year establishment phase, both the spruce and aspen were thinned to desired treatment densities.

The objective of the thinning was to achieve desired densities but retain potential crop trees at relatively uniform spacing. The study uses a randomized block design with each agency setting up and maintaining one block of two installations; one installation on a superior site and one on a median site. Each installation consists of two replications of 15 plots representing the different combinations of spruce and aspen treatment densities. Today, the study includes a total of 615 plots in Alberta, British Columbia, Manitoba, Saskatchewan and the Northwest Territories.

Data collection, database management and maintenance work continued in 2012. A new revised data collection manual was released in 2012 to deal with plot expansion and a new photo protocol that required photos to be taken from key plot locations.



Publications from the WESBOGY LTS

Bokalo, M., P.G. Comeau and S. J. Titus. 2007. Early development of tended mixtures of aspen and spruce in western Canadian boreal forests. For. Ecol. Manage. 242, 175-184.

Cortini, F., P.G. Comeau and M. Bokalo. 2012. Trembling aspen competition and climate effects on white spruce growth in boreal mixtures of Western Canada. Forest Ecology and Management 277:67–73.

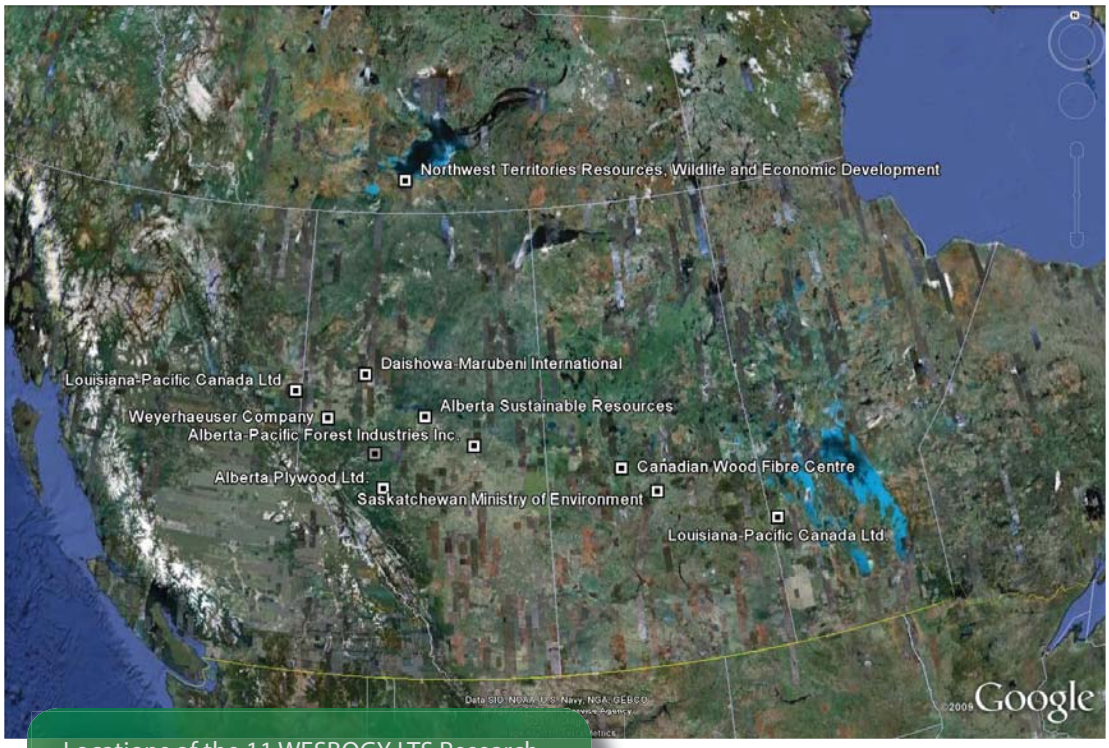
Filipescu, C.N. and P.G. Comeau. 2007. Aspen competition affects light and white spruce growth across several boreal sites in western Canada. Can. J. For. Res. 37: 1701-1713.

Filipescu, C. and P. Comeau. 2011. Influence of Populus tremuloides density on air and soil temperature. Scand. J. For. Res. 26:5, 421-428.

Voicu, M. and P.G. Comeau. 2006. Microclimatic and spruce growth gradients adjacent to young aspen stands. Forest Ecol. Manage. 221: 13-26

History and Locations of Long Term Study Installations

Company or Agency	Agency Code	Site	Year Spruce Established	Measurements Including 2013
Alberta Sustainable Resource Development	SRD	Med	1992	21
Alberta-Pacific Forest Industries Inc.	ALP	High Med	1994 2001	20 12
Canadian Forest Products Ltd.	CFR	High Med	2000 2001	13 12
Daishowa-Marubeni International Ltd.	DMI	High Med	1992 1992	21 21
Louisiana-Pacific Canada Ltd., Manitoba	LPSR	High Med	1998 1998	15 15
Louisiana-Pacific Canada Ltd., Dawson Creek	LPDC	High Med	2001 2004	12 10
Northwest Territories Resources, Wildlife and Economic Development	NWT	High Med	1993 1993	20 20
Alberta Plywood	WFR	High Med	1992 1993	19 19
Weyerhaeuser Company, Alberta Forestlands	WGP	High Med	1991 1991	22 22
Saskatchewan Ministry of Environment	SSK	High Med	1990 1990	23 23
Wood Fibre Centre, Canadian Forest Service	CFS	High Med	1992 1992	21 21



Locations of the 11 WESBOGY LTS Research Installations

MGM Development

Mike Bokalo, Phil Comeau and Steve Titus

MGM development and the formal process for it's approval for use in management planning in Alberta continued in 2013.

MGM Software Development

An alpha version (first production version used for testing) of MGM was developed in 2013. The new version is a migration to the professional software Visual Studio. development platform. This allowed better integration of MGM with Excel, Visual Basic and C++ code. Under the new platform, MGM is a compiled program which is able to be more portable, run faster and allow for better integration with other programs. The alpha version has seen the core growth and mortality functions re-written and compiled in Visual Basic. The redevelopment process included a vigourous validation process to ensure that results from the earlier version of MGM corresponded to results from the new version. The new version will also be validated against the published dataset to ensure that results from both versions are yielding the same results.

Model approval for use in management planning in Alberta

Two important steps in the approval process occured in 2013. Firstly, ASRD reviewed and compared the documentation provided on the MGM website to the internal code. Several suggestions were made to clarify certain aspects of model functionality, however the documentation was recieved well by ASRD. The second request by ASRD was to validate MGM on a new independent set of data provided under the provincial growth and yield initiative (PYGI). This provided more than 500 new PSP's for an independent validation. This validation should be completed in late 2014.

MGM Documentation and Website

The MGM documentation and model has been continually updated and enhanced in order to meet regulatory requirement of full model disclosure. The MGM Website (MGM.ualberta.ca) offers a publicly accessable portal for downloading MGM.

MGM Jack Pine Calibration

In 2013 the cooperative project funded by the Saskatchewan Environment, Alberta Pacific Forest Industries and the Alberta Environment and Sustainable Resource Development was in it's second year. The objective was to develop MGM height and diameter increment relationships, and mortality functions for Jack pine using existing Saskatchewan, Alberta and Manitoba PSP data and to use these in parameterizing MGM for jack pine. Initail difficulties in securing an individual with the skills to complete the project changed with the hiring of Vlad Strimbu (MSc). Vlad has made great strides in compiling and fitting the relationships to the data. The project is expected to be completed by March 31st 2015 as scheduled. The publication of the results and validation is expected in 2015.

Application of MGM

There has been continued development and demonstration of MGM's capabilities to model different tending/treatments scenarios. Several projects were initiated in 2013 that have moved MGM from a research model to a model used in forest management planning.

In late 2013, ALPAC was granted permission by ASRD to use MGM in the development of yield curves for treated managed stands. The process will mark the first use of MGM in management planning in Alberta. Mike will work closely with ALPAC as they proceed.

Tolko, Alberta Plywood and Vanderwell representing the Martin Hills FMA began the process of developing yield curves for understory protection stands. MGM was selected as a candidate model to predict future development of these spatially and vertically structured post harvest understory protection stands. Mike will take an active role in assisting in the data acquisition, compiling and modeling with MGM.

The use of LiDAR and Wet Areas Mapping (WAM) in representing Stand Structure and Unproductive Gaps in Forest Stands

Dan Jensen, Mike Bokalo, Phil Comeau and Barry White

Albeta Vegertation Inventory (AVI) polygons are often considered homogeneous and consistent with the biological definition of a stand, but in reality they are heterogeneous entities formed from many differently stocked sub-stands that on average represent the AVI forest stand structure.

This project has developed a method of using LiDAR and Wet Areas Mapping (WAM) to quantitatively estimate the percent area in gaps in a sample of stands in Alberta. Figure 1 shows the unmerchantable gaps detected using a 2 meter LiDAR raster. Of the total stand area (25.3 ha), approximately 4.8 hectares (19%) are in LiDAR gaps larger than 10m2. The LiDAR gaps however do not represent the true growing space available since the amount of crown encroachment into the open area is unknown. For every LiDAR gap the expanded gap represents the area from stem to stem obtained from field measurements. The expanded gap is a stable representation of the true growing space available by eliminating the crown encroachment effect (light green area; Figure 2). From a sample of LiDAR gaps within polygon 289, a strong relationship between LiDAR gap size and the expanded gap size can be seen (Figure 3). The slope of the non-linear regression line suggests that influence of the crown overhand varies with the size of the LiDAR gap. This research also is attempting to quantify the potential yield loss due to the presence of these gaps by estimating the number of merchantable trees that could occupy the unoccupied gaps. The detection and presence of natural gaps are thought to be strongly influenced by the depth to water. The correlation between gaps and wet areas is believed to be strong. Understanding the relationship between gaps and wet areas is now under investigation.

This study shows that the current resolution of LiDAR (1.68 hits/m2) is sufficient to identify and estimate the percent area within a stand that is contained in unproductive or unmerchantable gaps. It is believed that WAM will identify whether these gaps are related to topography and seasonal flooding. The application of these estimates will be used to operationally adjust estimated yield into ranges that are indicative of the landscape level yields found in natural stands an essential requirement for sustainable forest management. This project is Funded by Alberta Sustainable Resource Development.

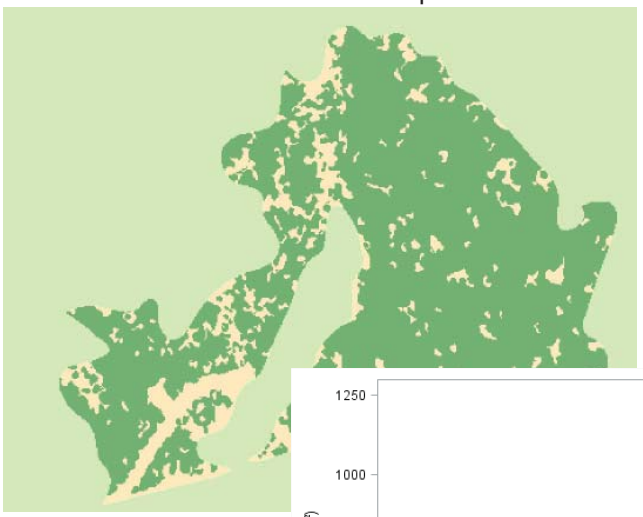


Figure 1.

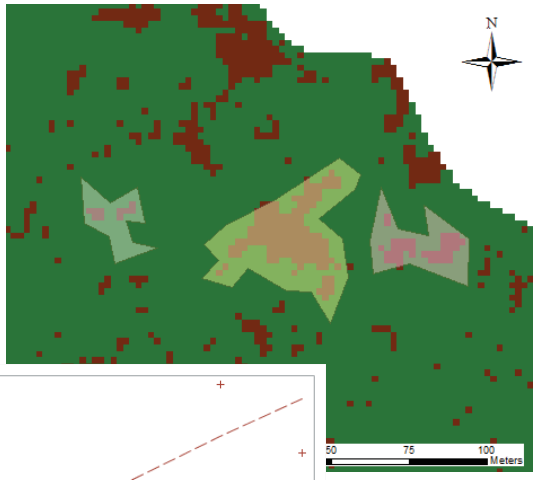


Figure 2.

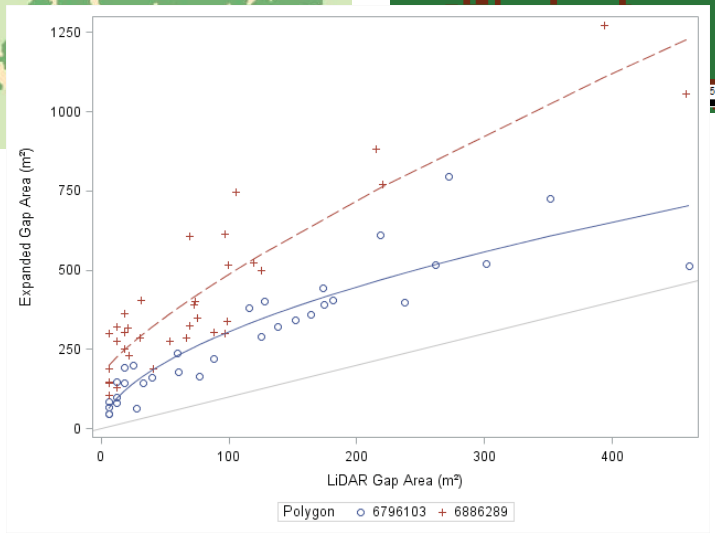


Figure 3.

Application of LIDAR in Forest productivity estimation

Introduction

Accurate determination of site index is critical to determining potential yield of regenerating stands and is a key input into growth and yield models. However, determining site index in spruce or aspen stands that are less than 15 years of age is problematic. While site index could be estimated from measurement of the original preharvest stand, this may be inaccurate due to: 1) the advanced age of the original aspen regeneration on the site (making accurate age determination problematic due to decay); and, 2) the fact that naturally regenerated spruce are rarely dominant but instead grow up under aspen and other vegetation during the first 60 to 80 years after regeneration. The use of ecological information, including both climatic and site factors, is being pursued in other areas. However, reliance on ground based assessments or predictive ecosystem mapping has limited its use. LIDAR and Wet Areas Mapping (WAM) may provide cost effective ways to obtain the needed ecological information, but while preliminary evaluations show that this approach is promising, it does need further development and testing.

With support from Alberta Environment and Sustainable Resource Developmen (2013-2015) we are undertaking two projects to explore application of LIDAR in the estimation of site index.

A. High precision prediction of site index and future yield by use of wet areas mapping and full feature LiDAR

Gabriel Oltean (M.Sc. Candidate, Univ. of Alberta), Phil Comeau (Univ. of Alberta), Mike Bokalo (Univ. of Alberta), John Nash (Greenlink), Daniel Chicoine (Incremental Forest Technologies) and Barry White (Alberta SRD).

Wet Areas Mapping uses the highly accurate LiDAR-derived digital elevation models to calculate the depth-to-water (DTW) and flow accumulation (FA) for each 1x1 m cell of the area. The flow initiation point depends on the catchment area, which we set at 0.5, 1, 2 (Fig.1 - left), 4, 8, 12, and 16 ha. During the summer of 2013 we assessed 88 plots at four WESBOGY LTS locations (WGP, DMI_HC, DMI_PR, SRD) and 37 plots at the Judy Creek research site (JC) for site and soil characteristics. Aspect and slope for each plot were measured and soil texture, humus type, organic matter thickness, depth-to-mottles, drainage, soil moisture and nutrient regime were determined. The geographical coordinates of every plot were recorded with a Trimble GeoXT handheld device connected to an external antenna to ensure sub-meter accuracy.

Soil moisture regime (Fig.1 - right), drainage class and depth-to-mottles were significantly related to DTW, FA and Slope of the plot. Comparison among the 7 threshold catchment areas and DTW indicate that a 2 ha catchment area is the strongest predictor for all three soil properties. The second best predictor was DTW at 1 ha, and then DTW at 4 ha. We suggest that using a smaller catchment area makes the DTW model more sensitive to the water behaviour in the soil and should couple more closely with tree growth and site productivity.

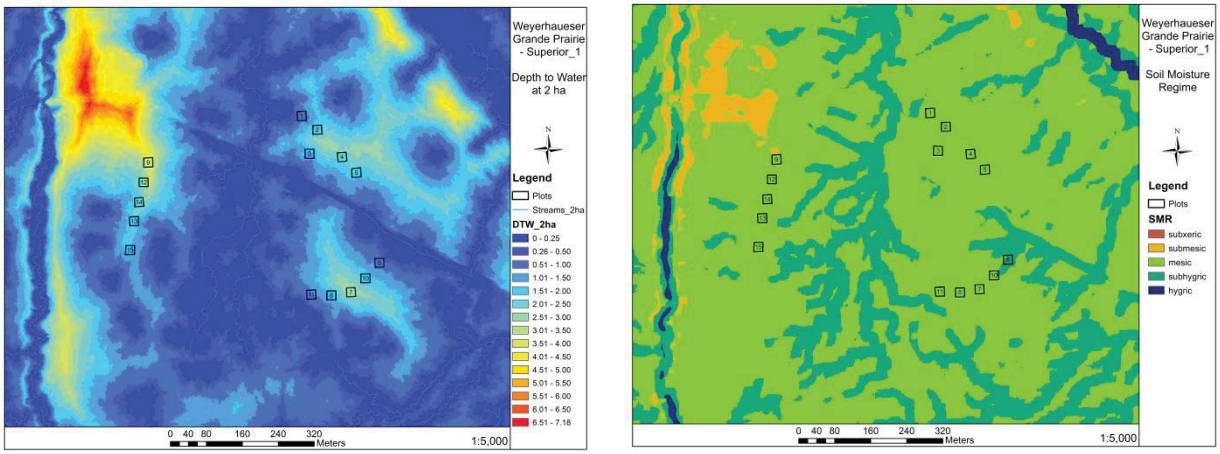


Fig.1. Left - Depth-to-water calculated at 2 ha, and Right - Soil Moisture Regime based on our model, for one block at Weyerhaeuser Grande Prairie LTS

B. Prediction of future forest productivity and silvicultural challenges using Full Feature LiDAR, Wet Areas Mapping and Landform: A case study using the 1968 Marten Hills Fire

Ivan Bjelanovic (M.Sc. candidate), Phil Comeau (Univ. of Alberta), Mike Bokalo (Univ. of Alberta), John Nash (Greenlink), and Barry White (Alberta ESRD).

Accurate determination of site index is critical to determining potential yield of regenerating stands and is a key input into growth and yield models. However, determining site index in spruce or aspen stands that are less than 15 years of age is problematic. While site index could be estimated from measurement of the original preharvest stand, this may be inaccurate due to: 1) the advanced age of the original aspen regeneration on the site (making accurate age determination problematic due to decay); and, 2) the fact that naturally regenerated spruce are rarely dominant but instead grow up under aspen and other vegetation during the first 60 to 80 years after regeneration. The use of ecological information, including both climatic and site factors, is being pursued in other areas. However, reliance on ground based assessments or predictive ecosystem mapping has limited its use. LIDAR and Wet Areas Mapping (WAM) may provide cost effective ways to obtain the needed ecological information, but while prelimary evaluations show that this approach is promising, it does need further development and testing.

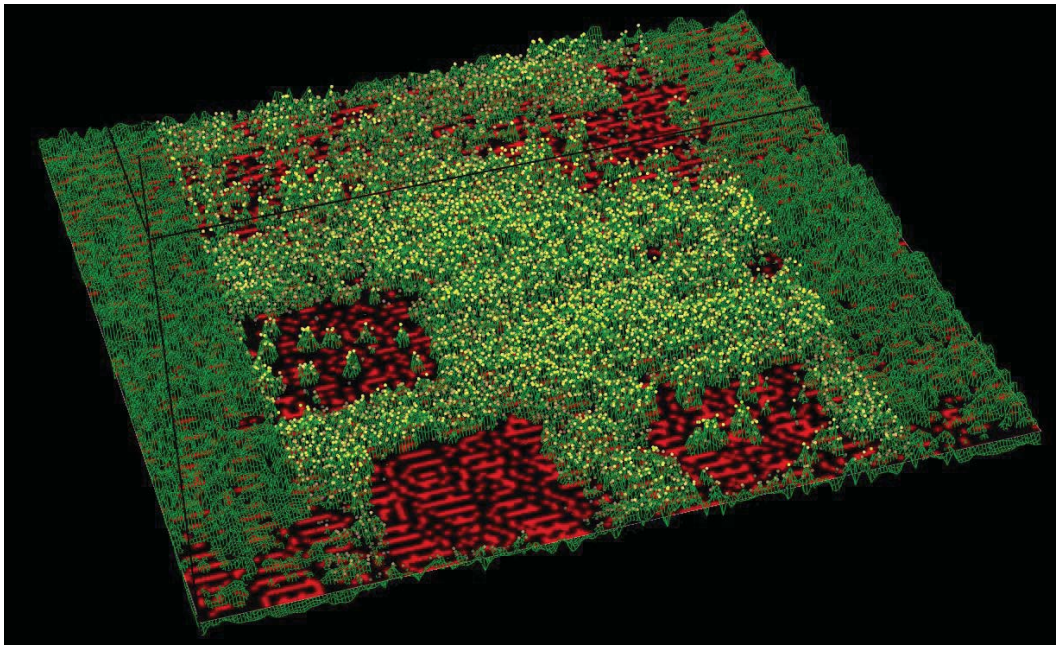
With support from Alberta Environment and Sustainable Resource Developmen (2013-2015) we are undertaking this project to explore application of LIDAR in the estimation of site index.

Objective: To evaluate the potential to use depth to water as well as slope, aspect, macro- and meso-slope position as informed by LiDAR to estimate soil moisture regime, aspen and spruce site index and competing vegetation potential.

Approach: For this study we will utilize data collected in the 1968 fire in the southern portion of management unit S17. Field sampling will be conducted across a broad range of depth to water, and site conditions for both species with a target of sampling 100 stands for each species.

A second part of this study will explore relationships between WAM estimates of soil moisture regime and the need for vegetation management treatments. This will involve selecting cutblocks in the Slave Lake – Marten Hills area and examining relationships between soil moisture regime and species composition, cover and height of vegetation.

Results from these studies will form the basis for Ivan's M.Sc. thesis.



LiDAR image of Weyerhaeuser WESBOGY Long Term Study.

Assessing juvenile growth and modeling long-term outcomes in Saskatchewan white spruce plantations

Kirk Johnson (M.Sc. candidate), Phil Comeau (Univ. of Alberta), Mike Bokalo (Univ. of Alberta)

Project Funded by the Saskatchewan Ministry of Environment -

In 2011 and 2012, sixteen white spruce (Picea glauca) plantations (13-18 years old) and eighteen managed-stand white spruce PSP's (20-29 years old) were sampled in the Prince Albert Forest Management Agreement to assess site preparation and tending effects, quantify juvenile growth, and evaluate the long-term implications of establishment and tending on future stand conditions.

Comparison of results from MGM simulations with observed growth from the managed stand PSP's illustrates the sensitivity of the model to site index assumptions. Since many factors can profoundly influence juvenile top height and site index (e.g. frost, animal browsing, leader whipping, stem breakage), initializing MGM with data from young stands (i.e. less than 15 years old) is potentially problematic. Future stand conditions (80 to 120 years) are being modeled using MGM with treelists based on the PSP data and four site index scenarios. Preliminary results show that juvenile mixedwood stands with a strong white spruce component and intermediate levels of deciduous competition are expected to achieve conifer-dominant (>75% conifer basal area) or conifer-leading mixedwood (50-75% conifer basal area) status by age 90.

Site preparation and tending effects were also investigated using the managed stand PSP's. Variably timed cleaning treatments and the absence of on-site control plots restrict silvicultural inferences. An assessment of site preparation and tending effects based on data from the sixteen white spruce plantations is ongoing. Project completion is expected by December 2014.

Spruce-pine plantation in early succession

Stand dynamics following canopy removal and release of advance regeneration in aspen and lodgepole pine dominated stands

Phil Comeau (Univ. of Alberta) , Valerie Krebs (Univ. of Alberta, M.Sc. candidate), Mike Bokalo (Univ. of Alberta), Greg Behuniak (Weyerhaeuser)Vic Lieffers (Univ. of Alberta), Ellen Macdonald (Univ. of Alberta), Gitte Grover (ALPAC), Ken Stadt (AESRD), Dan MacIsaac (CWFC), Derek Sidders (CWFC).

This project was developed following a workshop held August 14, 2014 that identified a need for better understanding of and modeling of growth and yield following: 1) understory protection harvesting of aspen stands with a spruce understory; and, 2) death of overstory lodgepole pine due to mountain pine beetle attack in stands with advance regeneration dominated by black spruce. The workshop was jointly sponsored by WESBOGY, Foothills Growth and Yield Association (FGYA); and the Alberta Forest Growth Organization (AFGO) and included participation by several members from each association. The proposed project was approved for funding under FRIAA Open Funds program for the period between April 1, 2014 and March 31, 2017.

Greg Behuniak, Weyerhaeuser Canada Ltd., Grande Prairie was the applicant. 14 companies signed on as co-applicants. Phil Comeau, Mike Bokalo, Vic Lieffers, Ellen Macdonald, Gitte Grover, Ken Stadt, Dan MacIsaac and Derek Sidders are project partners. Project work being undertaken primarily by graduate students supervised by Phil Comeau.

Work on the release response of white (A) and black (B) spruce will be the focus of two M.Sc. students thesis research. An M.Sc. student (Valerie Krebs) has been recruited to start work on the study of release response of white spruce starting in June of 2014. Her study will focus on examining effects of competition from neighbouring conifers on growth of released white spruce. She will collect data and destructively sample trees for growth measurement (beginning in July 2014) from 6 locations in Alberta. Sampling will be conducted near selected MWMA-SCUP installations, selected CFS-Adaptive Mixedwood study sites and at EMEND. Selection of candidate stands for the black spruce study will begin in 2014 and a Ph.D. student will begin work on this project in January 2015.

Notable Publications 2013-2014

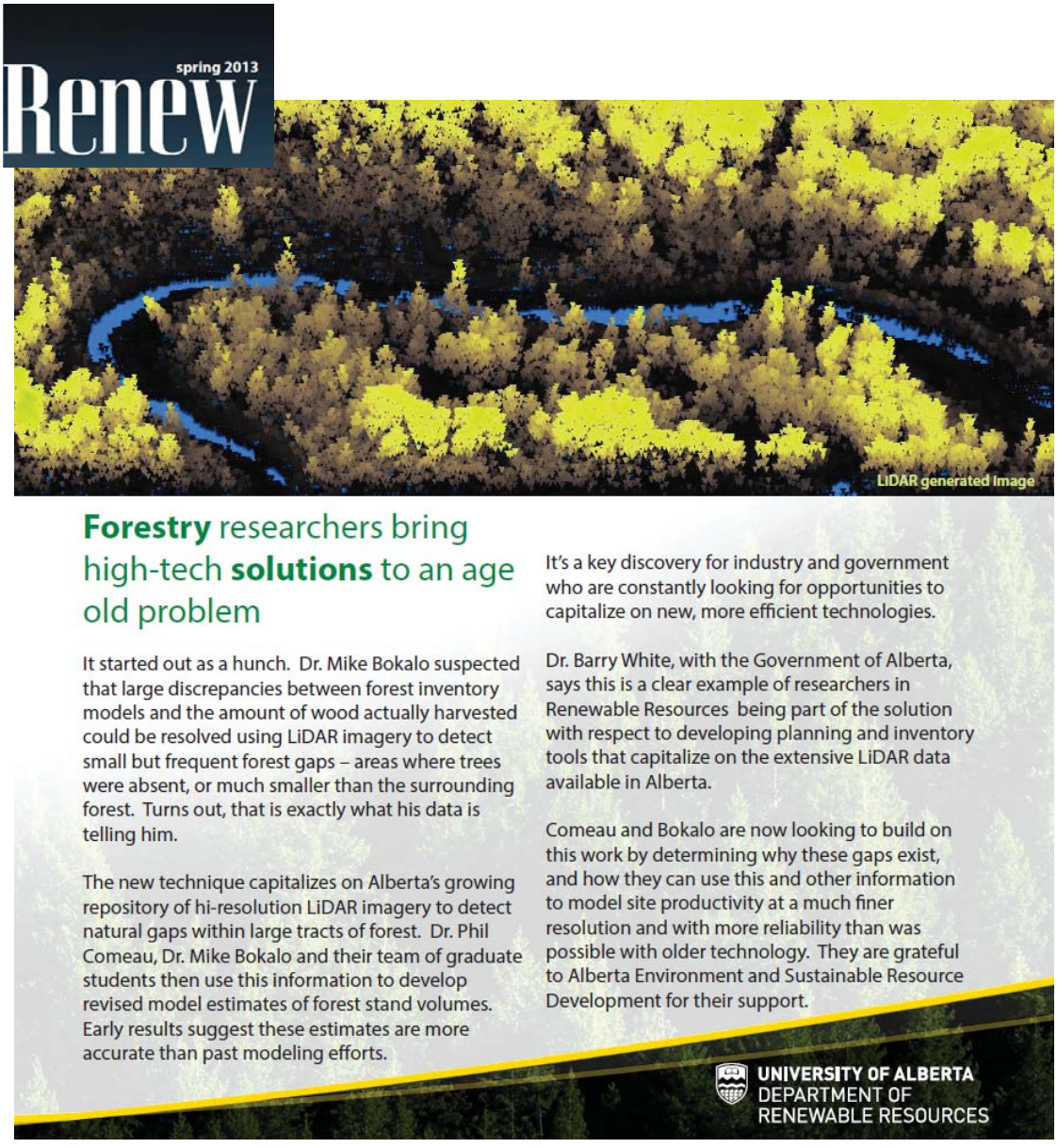
Derek F. Sattler, Philip G. Comeau, and Alexis Achim, **"Within-tree patterns of wood stiffness for white spruce (Picea glauca) and trembling aspen (Populus tremuloides)"** CJFR, 2014, 44(2): 162-171

*Gärtner, S. M., Bokalo, M., Macdonald, S. E., & Stadt, K. "***Variation in post-wildfire regeneration of boreal mixedwood forests: underlying factors and implications for natural disturbance-based management."** New Forests, 1-20 (2014).

*Reyes-Hernandez, Valentin, Philip G. Comeau, and Mike Bokalo. "***Static and dynamic maximum size–density relationships for mixed trembling aspen and white spruce stands in western Canada."** Forest Ecology and Management 289 (2013): 300-311.

Grover, Brigitte E., Mike Bokalo, and Ken J. Greenway. **"White spruce understory protection: From planning to growth and yield."** The Forestry Chronicle 90.1 (2014): 35-43.

Department of Renewable Resources Publication



by: Matthew Pyper - Fuse Consulting Ltd.

Graduate Students Working on Projects in the Western Boreal

Valentin Reyes-Hernandez (PhD) - Stand Density Index and its relationships with productivity and understory vegetation in the boreal mixedwoods in Western Canada

Hongan Yan (PhD) - The effects of competition control treatments on white spruce (Picea glauca [Moench] Voss) height and diameter growth

Derek Sattler (PhD) - Effects of density, species composition, age, and tree dimensions on wood quality for aspen and white spruce in boreal mixedwoods of western Canada (FORVALUENet Project 1.2)

Claudia Rivera-Rios (PhD) – Role of understory vegetation and effects of management practices on C cycling and sequestration in boreal mixedwood ecosystems

Kirk Johnson (MSc) – Influence of silviculture on the successional dynamics of mixedwood stands

Dan Jensen (MSc) – The use of Lidar and Wet Areas Mapping (WAM) in representing Stand Structure and Unproductive Gaps in Forest Stands

Gabriel Oltean (MSc) –Estimation of site productivity and potential growth of top height trees using a remotely sensed depth-to-water index

Ivan Bjelanovic (MSc) - Prediction of future forest productivity and silvicultural challenges using Full Feature LiDAR, Wet Areas Mapping and Landform: A case study using the 1968 Marten Hills Fire

29th Annual WESBOGY fall meeting
Location: Centre 2000
11330- 106 St, Grande Prairie, AB, T8V 7X9
Sept. 17 & 18th, 2013
Sponsored by: Weyerhaeuser & Canfor

Monday Sept. 16, 2013
Evening Mixer: Best Western "Padrino's" Italian Ristorante

Tuesday Sept. 17, 2013
Mountain Pine Beetle Issues and Management – WGP and Canfor
MGM Update - Plans and priorities for MGM
LiDAR Gap study – Dan Jensen
Gap Loss Factor Reconciliation and Application in MGM - Mike
LiDAR projects - Phil
Adaptive Mixedwood Management Study– Derek Sidders
MGM Long Term Projection Results – Adaptive Mixedwood Study - Mike

Presentations and Growth and Yield Forum
1) Gitte Grover – Understory Protection Harvesting: Planning and Growth and Yield
2) Darren Aitkin – Provincial Growth and Yield Initiative (PGYI)
3) Erin Fraser – AESRD Understory Protection Regen Standards Update
4) Growth and Yield Forum

WESBOGY Business Meeting (3:30 to 5:00)
6:00 pm - BBQ SUPPER (Sponsored by Canfor and Weyerhaeuser)

Wednesday Sept. 18th - Field Tour
8:00 am – field tour bus departs
Stop – Adaptive Mixedwood Study
Stop – Weyerhaeuser WESBOGY Installation
Stop – Volume Loss Estimation - LiDAR Gap Field Study
Stop – Forest Management in a Mountain Pine Beetle Environment
4:00 pm – field tour bus returns to Grande Prairie

Planned WESBOGY Meetings in 2014

The 2014 Annual Spring Meeting is planned for April 24, 2014 on the University of Alberta campus. The 2014 Annual Fall Meeting will be sponsored by the Saskatchewan Ministry of Environment and the Canadian Forest Service in Prince Albert Saskatchewan on September 17th and 18th, 2014.

History of WESBOGY Meetings

Date	Sponsor	Location
2013 Sept 17 - 18	Weyerhaeuser and Canadian Forest Products	Grande Prairie, AB
2012 Sept 11-12	Louisiana Pacific Canada Ltd.	Swan River, MB
2011 Oct 4-5	Daishowa-Marubeni International Ltd	Peace River, AB
2010 Sept 14-15	Manning Diversified Forest Products	Manning, AB
2009 Sept 15-16	University of Alberta	Whitecourt, AB
2008 Sept 8 -10	Alberta Plywood	Slave Lake, AB
2007 Sept 4-6	Alberta-Pacific Forest Industries	Lac La Biche, AB
2006 Aug 29-Sept 1	Louisiana Pacific Canada Ltd.	Dawson Creek, BC
2005 Aug 29 - Sept 1	Northwest Territories Resources, Wildlife and Economic Development	Hay River, NWT
2004 Aug 30 - Sept 1	Saskatchewan Environment – Forest Service	Prince Albert, SK
2003 Sept 9-11	Canadian Forest Products Ltd.	Grande Prairie, AB
2002 Sept 9-11	Louisiana-Pacific Canada Ltd.	Riding Mountain, MB
2001 Sept 9-11	Daishowa-Marubeni International Ltd.	Peace River, AB
2000 Sept 6-8	Weyerhaeuser Company, Drayton Valley	Edson, AB
1999 Sept 23-25	Weyerhaeuser Company, Prince Albert	Anglin Lake, SK
1998 Oct 7-9	Alberta-Pacific Forest Industries Ltd.	Athabasca, AB
1997 Oct 7-9	British Columbia Ministry of Forests	Dawson Creek, BC
1996 Nov 6-8	Daishowa-Marubeni International Ltd.	Peace River, AB
1995 Oct 11-13	Weldwood of Canada Ltd.	Hinton, AB
1994 Oct 12-14	Weyerhaeuser Company, Alberta Forestlands	Big River, SK
1993 Nov 4	University of Alberta	Edmonton, AB
1992 Oct 6-7	Weyerhaeuser Company, Grande Prairie	Grande Prairie, AB
1991 Oct 24-25	Weyerhaeuser Company, Prince Albert	Prince Albert, SK
1990 Nov 22	University of Alberta	Edmonton, AB
1989 Mar 15	Canadian Forest Service	Saskatoon, SK
1988 Nov 4	Canadian Forest Service	Whitecourt, AB
1998 Feb 4-5	Canadian Forest Service	HInton, AB
1987 Mar 27	Canadian Forest Service	Edmonton, AB
1986 Feb	Canadian Forest Service	Edmonton, AB
1985 Nov 15	Canadian Forest Service	Edmonton, AB
1985 Oct 24	Canadian Forest Service	Banff, AB
1985 Mar 23	Canadian Forest Service	Edmonton, AB

WESBOGY Website and Sharepoint Site

With the assistance of Judy Huck (U of A, Department of Renewable Resources Webmaster / Multimedia Technician) our new website is up and running. Changes include: having our own web address, a secure members area, and inclusion of both historical and current documents in readily accessible formats.

Check out our:

WEBSITE at: http://wesbogy.ualberta.ca
Sharepoint Site at: https://portal.ales.ualberta.ca/wesbogy/default.aspx

WESBOGY Financial Summary For 2013-2014

Description	Budgeted Amount	Actual Expenditures	Difference
Salaries & Benefits			
Research Scientist salary	$100,000	$110,068	-$10,068
Field and office tech support salary	$16,000	$16,038	-$38
Grad students/Research Projects (salary)	$5,000	$4,800	$200
Professional (MGM Programmer / Analyst)	$10,000	$10,150	-$150
Travel (Wesbogy Meetings, travel & Judy Creek)	$8,500	$7,655	$845
Supplies, Equipment, Communication, Vehicle rental	$6,000	$6,200	-$200
Overhead (15% of member contributions)	$16,875	$16,875	$0
Overhead (20% of AESRD contributions)	$2,500		$2,500
Overhead (15% of CFS contributions)	$1,875	$1,875	$0
TOTAL	$166,750	$173,661	-$6,911
Balance at March 31, 2014			
Opening Balance April 1, 2013		$158,989	
Member Contributions (in Jan-March 2014)		$112,500	
CFS contribution (Feb 2014 for 2013 dues)		$12,500	
Expenditures 2013/2014		-$173,661	
Balance at March 31, 2014 (Main account)		$110,328	
Total Year End Balance		$110,328	
Accounts receivable		$25,000	
WESBOGY - Budget for 2014/15			
Description	**Amount**		
Salaries & Benefits			
Research Scientist	$100,000		
Field and office tech support	$16,000		
Grad students/Research Projects	$5,000		
Professional (MGM Programmer/Analyst)	$14,000		
Travel (Wesbogy Meetings, travel & Judy Creek)	$9,000		
Supplies, Equipment, Communication, Vehicle rental	$6,200		
Overhead (15% of member contributions, 20% AESRD)	$21,250		
TOTAL	$171,450		
Projected Balance at March 31, 2015			
Opening Balance April 1, 2014		$110,328	
Member Contributions (in Jan-March 2015)		$137,500	
Expenditures 2014/2015		-$171,450	
Accounts Receivable		$25,000	
Estimated Balance at March 31, 2015		$101,378	

Member Contact Information

Company or Agency	Contact	Email
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Wood Fibre Centre, Canadian Forest Service, Natural Resources Canada	Dan MacIsaac (780) 435-7332 Derek Sidders (780) 435-7355	Dan.MacIsaac@NRCan-RNCan.gc.ca Derek.Sidders@NRCan-RNCan.gc.ca

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