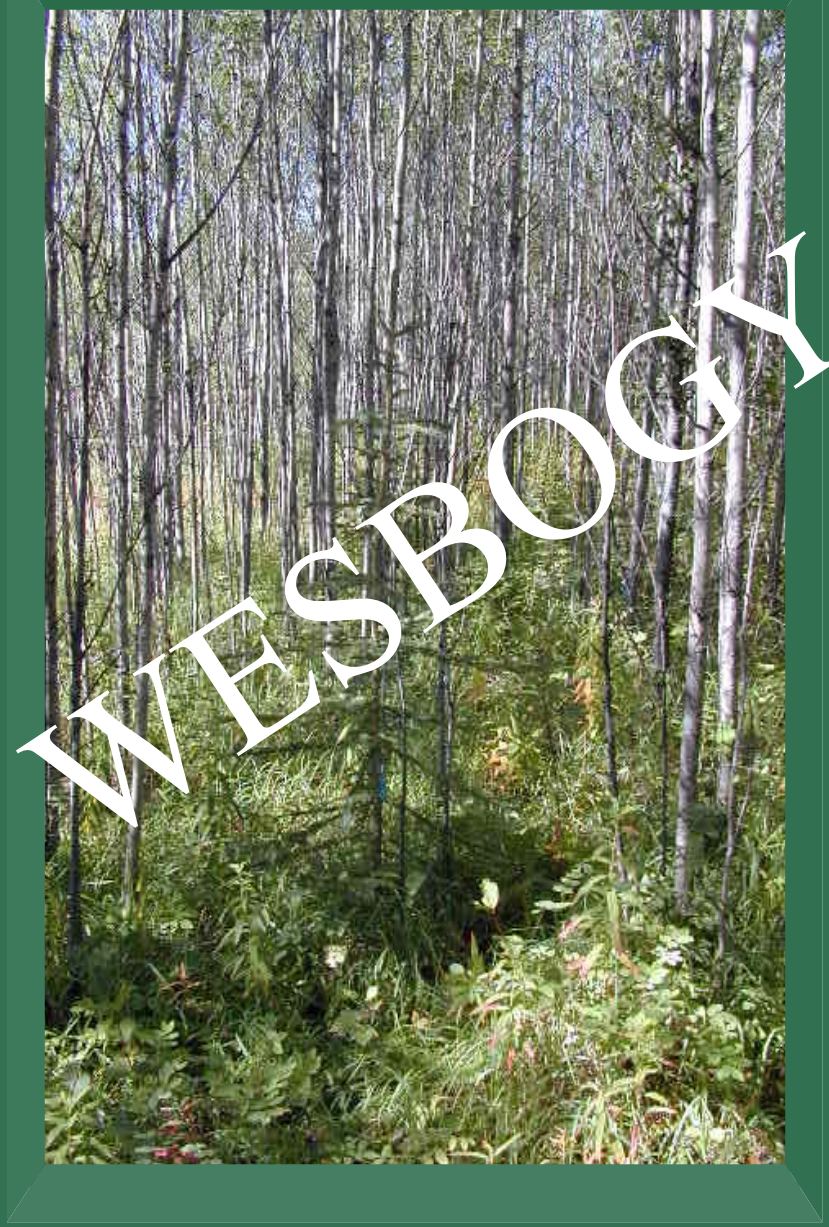
Annual Report
2005–2006



WESTERN BOREAL GROWTH AND YIELD ASSOCIATION

April 2006

CONTENTS

Executive Summary and Highlights

The Western Boreal Growth and Yield Association first met in the mid 1980's as an informal group of agencies involved in forest growth, yield, inventory and planning in western Canada. The association works to: encourage member agencies to work in a coordinated fashion to improve the efficiency of their research and development efforts; facilitate data sharing; and, provides a forum for communication. We are focused on development and dissemination of growth and yield modeling technology and information for both natural and regenerated stands in the western boreal mixedwood region, primarily aspen and spruce.

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

Continuing work on the long-term study designed to examine the effects of manipulating aspen density on growth and yield of mixedwood stands during 2005 included cleaning and archiving of data collected through 2004, revision of the field data collection manual, and analysis of data. Work on the Mixedwood Growth Model continues, with support received from the Forest Resource Improvement Association of Alberta (FRIAA) and the Mixedwood Management Association. In addition, a number of studies are underway that will contribute to better or more efficient tending of young mixedwood stands. The association has been represented at various meetings and workshops, and posters displaying work on MGM and other projects have been displayed at the CIF fall meeting in 2005 and at the Post-Harvest stand development conference in early 2006.

This Annual Report presents highlights of work accomplished during 2005, and outlines the projects and priorities for 2006-2010.

Northwest Territories WESBOGY LTS installation site visit
Photo Credit: Phil Loseth

April 2006

Photo Credit: Phil Loseth

The past year has seen substantial progress on several WESBOGY priorities. The database for the long-term study now contains all current data through 2004, with final corrections only now required for 2005 data. In 2005 we now have 6 installations which have passed the 14 year point (9 years post thinning). We now have energetic plans to complete compilation and analysis of this data (a priority for 2006!). Work on MGM, funded by the Forest Resource Improvement Association of Alberta, the Alberta Mixedwood Management Association, and WESBOGY, has focused on improving mortality functions for spruce and developing capabilities for splitting stands into "strata" representing spatially discrete portions of stands with different structures. Mike Bokalo, Steve Titus and Ken Stadt are leading work on MGM.

We had yet another exceptional fall meeting and tour in the NWT in August of 2005. Excellent hosts, interesting discussion, and interesting stops during the tour! Presentations on habitat modeling during the meeting stimulated substantial interest and discussion. In February of 2006, Mike and Phil participated in the Post-harvest stand development conference, hosted by the Foothills Growth and Yield Association.

In January of 2006, we started on a new 5 year agreement with all members. We are pleased that all current members are continuing, and we are pleased to welcome Alberta Plywood as a new member (in place of Hinton Wood Products).

The coming year holds new promises as we continue work on the LTS data, on MGM and on many of the associated projects that we have underway. This report contains information on several of the projects that we have underway. If you require any further information please contact Mike Bokalo or myself.

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Mission Statement and Goals

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. A business plan outlining project priorities and allocation of resources to accomplish the mission will be developed and periodically reviewed with the participation of Steering Committee members.

GOALS

1. 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.
2. To increase knowledge and awareness of growth and yield relationships, as they exist in western and northern Canada.
3. 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.
4. 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 site productivity will also be evaluated where there is sufficient data.
5. 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;
6. 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;
7. To facilitate the dissemination of growth and yield data through the development of appropriate procedures, standards and databases for members' use.

Alexandra Falls, NWT
Photo Credit: Phil Loseth

5-Year Objectives

The following table lists measurable objectives identified for the 2006-2011 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 field and technical meetings for dissemination of information obtained from ongoing 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**

Photo Credit: Phil Comeau

5-Year Program (2006-2010)

1. To continue analysis of the WESBOGY long-term study data 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 in treated plots.
   - Recruitment (ingress) of new trees into natural and treated plots.
   - Preparation of manuals and reports 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;
   - Partial cutting amount and method.
   - Site preparation.
   - Brushing and vegetation management
   - Influence of site, age and other factors on aspen-conifer interactions..
3. To update the WESBOGY long-term study data collection manual and the WESBOGY web 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 in both silviculture practices and growth modeling.
5. To organize the WESBOGY Fall, Spring, and Steering Committee meetings each year. Prepare the meeting minutes and WESBOGY annual reports.
6. To develop height, diameter, and mortality functions for other species.
   - To develop relationships for poplar and black spruce using available PSP data.
   - To prepare manuals and reports for distribution to members and for journal publication.
7. Review, summarize, and prepare a report of regional PSP database standards and protocols for data exchange and use in regional growth models.
8. To review and update the list of priority and ongoing projects.
9. To undertake high priority research projects as recommended by the Steering Committee and approved by the members.

Northwest Territories WESBOGY LTS installation site visit
Photo Credit: Phil Comeau

The following table summarizes current and potential projects and their respective priorities. This table is a working document that is subject to periodic review. Members are encouraged to submit suggestions for new entries.

Research Priorities and Projects (November 16, 2005)

	Subject Class	Subject/Title	Description/Justification	Status and Priority	Comments
1.	Growth Modeling	Development of MGM	Continue development of MGM. Current initiatives include: a) Incorporation of new results into MGM from on-going WESBOGY and other research projects. b) Improved juvenile growth and mortality models c) Validation of mature and juvenile predictions d) Improved modeling of response to silviculture e) Improved predictions of landscape level yields f) Addition of new functionality to model multiple strata. g) Offer MGM user training sessions. Continue to secure funding from outside sources to support further development of MGM.	**Status:** Underway **Priority**: High **Agencies**: **Researchers:** Mike Bokalo, Ken Stadt, Steve Titus, Phil Comeau	FRIAA and MWMA funding 2004-2006
2.	Silviculture and Growth Modeling	Maintenance of Long Term Study Database	Continue to maintain the LTS data and databases. Current Initiatives: a) Continued acquisition, cleaning and development of the LTS master tree database. b) Implementation of annual data acquisition protocol c) Conversion to new condition codes d) Acquisition, input and linking of the Ecological, Soils and Spatial Data e) Update and maintain LTS data collection manuals	**Status:** Underway **Priority**: High **Agencies**: **Researchers:** Mike Bokalo, Phil Comeau	
3.	Silviculture and Growth Modeling	Analysis of Long Term Study Data	Continued analysis of LTS data a) Development of juvenile aspen and spruce growth, mortality and ingrowth functions b) Continued development of aspen self-thinning relationships c) Analysis of treatment effects on both aspen and spruce growth and mortality.	**Status:** Underway **Priority**: High **Agencies**: **Researchers:** Mike Bokalo, Phil Comeau	
4.	Growth Modeling	MGM- Volume Loss Factor development	Develop volume loss factors relating to stand classes, stocking, pathogens and other factors.	**Status:** Underway (started in 2005) **Priority**: High **Agencies**: **Researchers:** Cosmin Tansanu (M.Sc.). Mike Bokalo and Phil Comeau	FRIAA and MWMA funding 2005-2006

	Subject Class	Subject Title	Description/Justification	Status and Priority	Comments
5.	Silviculture	Evaluation of competition indexes using LTS data	Using data from the oldest LTS sites, examine the effectiveness of various distance independent and distance dependent competition indexes, as well as effect of assessment radius	**Status:** underway **Priority:** High **Agencies**: **Researcher**: Phil Comeau	
6.	Growth Modeling	Evaluating the predictive performance of several growth models calibrated for Saskatchewan	A two year project, to compare and evaluate the predictive performance of the following models: – Saskatchewan Provincial Empirical Yield Curves, – Dendron and Flewelling Growth models; - Preliminary natural stand growth and yield estimation for Saskatchewan, 1995. – Mixedwood Growth Model (MGM).	**Status:** Underway (started February 2005) **Priority**: High **Agencies**: Saskatchewan Forest Centre, Saskatchewan Environment - Forest Service, Weyerhaeuser, Prince Albert **Researchers:** Cosmin Tansanu (MSc), Mike Bokalo and Phil Comeau	
7.	Disturbance and succession	Pine - Aspen interactions	To evaluate the effects of aspen on growth of lodgepole pine and the dynamics of mixtures of lodgepole pine and aspen	**Status:** Underway **Priority**: High **Agencies**: FGYA (FRIAA funded project) **Researchers:** Phil Comeau, Dick Dempster and Vic Lieffers	Field work (measurements) initiated in November 2005. FRIAA funding to FGYA
8.	Silvicultural Treatment and Growth	Response of stands (natural origin) to silvicultural treatment (e.g. site preparation, thinning, weeding, cleaning, planting and fertilization)	Evaluation of NIVMA TRENDS data for site preparation, planting and vegetation management responses. Step 1- Summarize data and complete analysis of effects of MSP, stock type, and vegetation management on survival and growth.	**Status:** Step 1 completed in February 2006 **Priority:** High **Agencies:** NIVMA **Researcher**: Phil Comeau	**Data**: Alberta TRENDS data; Collaboration with CFS (Krygier) and others to assemble and analyze data and compile information. Funding by Alberta NIVMA (Weyerhaeuser, DMI, Tolko, ANC)
9.	Silvicultural Treatment and Growth	Silvicultural prescriptions to maintain mixedwood stands	Collaboration between Phil Comeau, Doug Pitt (CFS), Milo Mihajolovich (IFTech Ltd.) and Dan MacIsaac (CFS) on project entitled - "Effects of aspen density and duration of vegetation control on resource competition and mixedwood stand development" - it involves testing some tending options for creating mixedwood stands.	**Status:** 2002-on-going **Priority:** High **Agencies:** Funded by AFPA, MWMA, several companies and NSERC. **Researcher**: Cosmin Man (M.Sc.) and Phil Comeau	**Data**: Work is being done at Judy Creek, on Blue Ridge limits, near Whitecourt.
10.	Silvicultural treatment and growth	Evaluation of options for enhancing conifer growth in mixedwood stands	A study to evaluate the impact of radius of manual and herbicide treatments on spruce growth and on stand dynamics and composition.	**Status:** 2000 – On-going **Priority:** High **Agencies:** Alberta Plywood, Dow Agrosciences **Researcher**: Phil Comeau	**Data:** Experiment established near Slave Lake in 2000. Being maintained and periodically remeasured
11.	Silvicultural treatment and growth	Competition dynamics in young mixedwood stands	Examine effects of site, age, and density on aspen-spruce interactions. Study to evaluate use of various competition models and their effectiveness across a range of blocks and stand ages	**Status:** Initiated 2001 **Priority**: High **Agencies**: NSERC and MWMA funded **Researcher:** Cosmin Filipescu (PhD) and Phil Comeau;	**Data**: Supplementary measurements and data collection on LT research installations, plus use of collected data. Age effects are being examined in a separate set of chronosequenced stands.
12.	Disturbance and succession	Spatial aspects of boreal mixedwood succession and stand dynamics	Examining relative impacts of competition for both light and physical interactions. How does ownership of the ground by aspen and spruce change over time?	**Status**: Initiated 2001, expected completion 2006 **Priority:** High **Agencies:** CFS, funded by SFM **Researcher**: Dan MacIsaac (Ph.D. student), Ellen Macdonald, Phil Comeau	Thesis and papers to be completed during 2006.

	Subject Class	Subject Title	Description/Justification	Status and Priority	Comments
13 .	Ecology	Grass and aspen competition for water	Evaluate the effects of Calamagrostis canadensis on soil moisture under aspen stands of different densities. Using DMI Hines Creek Installation.	**Status**: Initiated 2004 **Priority:** High **Agencies:** DMI **Researcher**: Phil Comeau	Herbicide treatments completed in 2 m x 2 m patches in selected plots in 2004. Soil moisture, temperature and LAI being monitored. Have experienced two wet summers since starting and no evidence of soil moisture problems or grass impacts.
14 .	Succession	Stand Reconstruction	To determine if past history of stands can be reconstructed using destructive sampling techniques. Focus is on reconstructing successional changes as well as past densities.	**Status:** Proposed **Priority:** Medium **Agencies:** WESBOGY, MWMA **Researchers:** Mike Bokalo, Phil Comeau	
15.	Silvicultural treatment and growth	Effects of timing and radius of cutting on spruce growth and aspen resprouting	Examine the effect of age and radius of aspen removal on spruce growth and on aspen resprouting.	**Status:** To be initiated in 2006 **Priority**: High **Agencies**: ALPAC **Researcher:** Phil Comeau	Site selection completed in 2005. Initial measurement and treatment to be completed in 2006. NSERC Discovery Grant funded.
16 .	Ecology	Effects of aspen density and basal area on understory LAI and plant community diversity.	Evaluate treatment effects in LT study on understory leaf area index, species composition and coverage at ages 10 and 15.	**Status**: Proposed (to start in 2006). **Priority:** High **Agencies:** all members **Researcher**: Sheelah Griffith (M.Sc.) Phil Comeau	Initial work done on LAI in 2005 at DMI Hines Creek LTS installation. Biodiversity work will focus on WGP LTS installation in 2006, with LAI measurements collected at WGP, DMI, ALPAC, and Canfor installations. Funded by WESBOGY and FRIAA.
17.	Growth and Yield	Modeling young stand response to establishment and tending.	Develop a young stand model as a tool to aid in quantifying benefits of msp, planting stock, herbicide and brushing treatments. Model to grow stands to age 14 to 20 then generate tree lists for MGM.	**Status:** Proposal/plan under development **Priority:** High **Agencies**: NIVMA, FGYA, AFRI, **Researcher**: Phil Comeau	Hybrid process modeling, representing key limiting/ controlling factors is envisioned. Initial work may provide a stand-alone model, but if feasible this may be incorporated directly into MGM.
18 .	Silviculture	Evaluation of banding as an alternative for establishing mixedwood stands	Establish studies to demonstrate and test the potential use of patch/ banding treatments for growing white spruce in mixedwood stands.	**Status:** Underway (January 2006) **Priority:** High **Agencies**: MWMA (funded by MWMA) **Researcher**: Phil Comeau, Ken Greenway and Gitte Grover.	3 installations to be established in 2006 and 3 more in 2007. Treatments involve establishment of planted white spruce with and without site preparation and creation of 15 m wide aspen free bands using glyphosate herbicide or cutting.
19.	Ecology	Biodiversity effects of silviculture practices on boreal mixedwood sites.	Evaluate effects of establishment and tending practices on species and structural diversity on boreal mixedwood sites.	**Status:** identified by Saskatchewan Environment. **Priority:** Medium **Agencies:** Saskatchewan Environment	Evaluate impacts of aspen density manipulation (LTS) in comparison to other options (msp, herbicide treatments, …). Develop modeling/ predictive capabilities linked with MGM or other models. Linked with #16.

Membership

Agency/Company	2001	2002	2003	2004	2005
Alberta Sustainable Resource Development	X	X	X	X	X
Alberta-Pacific Forest Industries Inc.	X	X	X	X	X
Alberta Plywood					X
British Columbia Ministry of Forests	X	X	X		
Canadian Forest Products Ltd.	X	X	X	X	X
Daishowa-Marubeni International Ltd.	X	X	X	X	X
Hinton Wood Products Ltd.	X	X	X	X	
Louisiana-Pacific Canada Ltd., British Columbia	X	X	X	X	X
Louisiana-Pacific Canada Ltd., Manitoba	X	X	X	X	X
Manning Diversified Forest Industries Ltd.	X	X	X	X	X
Northwest Territories Resources, Wildlife and Economic Development	X	X	X	X	X
Saskatchewan Environment and Resource Management	X	X	X	X	X
University of Alberta	X	X	X	X	X
Weyerhaeuser Company, Alberta Forestlands	X	X	X	X	X
Weyerhaeuser Company, Saskatchewan Forestlands	X	X	X	X	X

Steering Committee Members

A Steering Committee, consisting of three 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.

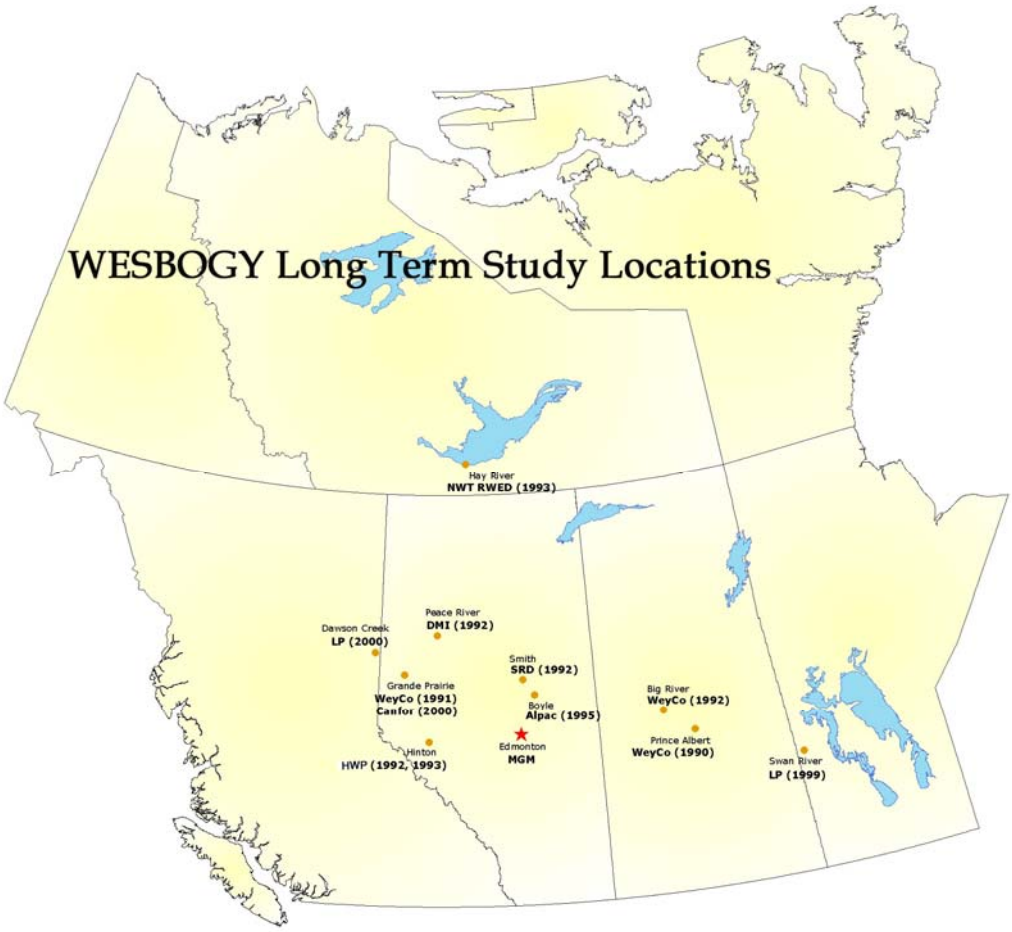
2000 Titus, Wang, Behuniak, Niemi, Weeks
2001 Titus, Behuniak, Niemi, Nichol, Ewan
2002 Titus, Bokalo, Comeau, Behuniak, Niemi, Nichol, Ewan
2003 Comeau, Bokalo, Titus, Behuniak, Niemi, Nichol, Ewan/Ashley
2004 Comeau, Bokalo, Titus, Behuniak, Nichol, Ashley, Whittaker
2005 Comeau, Bokalo, Titus, Behuniak, Nichol, Ashley, Whittaker

Long Term Study of Aspen/Spruce Stand Development

The design of the Long-Term Study involves planting white spruce seedlings in recently clearcut areas where aspen regeneration had already been established. Spruce seedlings were planted in both the plot and buffer areas. For the first 5 years, vegetation is controlled by clipping or using plastic mulch mats within a 40 to 50 cm radius of the spruce. After 5 years, both the spruce and aspen are thinned to desired treatment densities. The objectives of the thinning are 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, comprised of two installations. Each installation consists of two replications of a series of 15 plots.

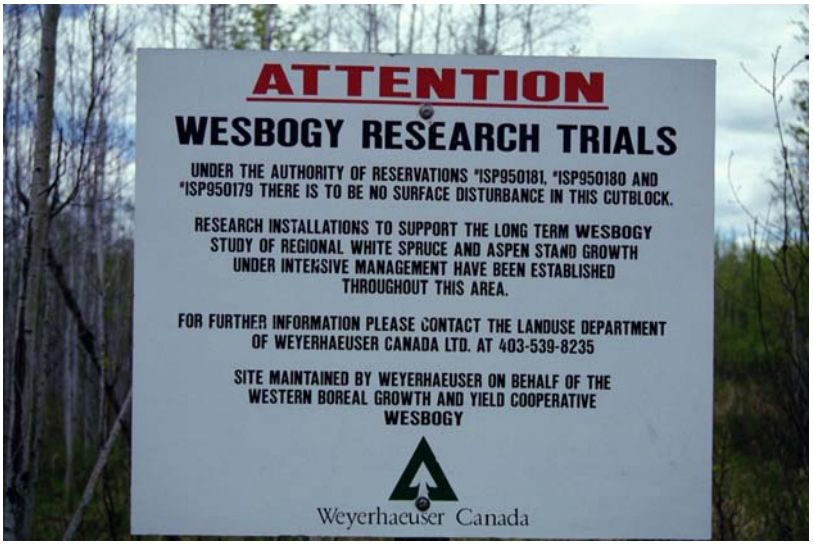
In 2005, along with the annual collection of tree data, the main focus was the continued cleaning of the data collected in 2004 and 2005. Susan Humphries was hired on a part time basis to coordinate the cleaning process and to begin the development of the protocols and guides needed for the acquisition and inputting of the spatial, ecological, site and soils data. In 2006 the data collection manual and supplementary manuals for site, soils and ecological data will be made available.

The data collection manual is available for downloading in PDF form from the WESBOGY website **http://www.wesbogy.rr.ualberta.ca/data_manual.asp**



Long Term Study Measurement Schedule

Company or Agency	Agency Code	Site	Year Spruce Established	Measurements Including 2005
Alberta Sustainable Resource Development	SRD	Med	1992 2001	14 5
Alberta-Pacific Forest Industries Inc.	ALP	High Med	1995 2001	9 4
Canadian Forest Products Ltd.	CFR	High Med	2000 2001	5 4
Daishowa-Marubeni International Ltd.	DMI	High Med	1992 1992	14 14
Louisiana-Pacific Canada Ltd., Manitoba	LPC	High Med	1998 1998	8 8
Louisiana-Pacific Canada Ltd., Dawson Creek	LPD	High Med	2001 2001	5 5
Northwest Territories Resources, Wildlife and Economic Development	NWT	High Med	1993 1993	13 13
Alberta Plywood	APL	High Med	1992 1993	14 13
Weyerhaeuser Company, Alberta Forestlands	WGP	High Med	1991 1991	15 15
Weyerhaeuser Company, Saskatchewan Forestlands	WPA	PA High PA Med BR High BR Med	1990 1990 1992 1992	16 16 15 14



Mixedwood Growth Model (MGM) Development

In 2005 the development of MGM was in its second year of a 3 year project supported by the Forest Resource Improvement Association of Alberta - Open Funds Initiative to further develop MGM's capabilities. This collaborative project involving the University of Alberta Department of Renewable Resources, the Government of Alberta, the Western Boreal Growth and Yield Association and the Alberta Mixedwood Management Association (MWMA) is lead by Phil Comeau (Principle Investigator) and Mike Bokalo (Project Leader). The project is designed to incorporate into MGM the flexibility and functions that are needed to model and assess growth and yield implications of current and future forest management strategies and silvicultural prescriptions in Alberta's boreal mixedwood forests. The project is being directed by a Strategic Development Team whose members are: Phil Comeau, Steve Titus, Mike Bokalo, Ken Stadt, Greg Behuniak, Gitte Grover, Ken Greenway, Yuqing Yang and Willi Fast.

During 2004 work focused on three major components. First, the conversion of MGM to operate entirely within the framework of a Microsoft Excel workbook and Visual Basic for Applications (VBA). The second was to improve the representation of early tree and stand growth using newly available juvenile stand data (WESBOGY LTS, SRD SDS, Monitor Plot, and other industry data). This third component focused on improving existing juvenile growth and mortality functions for trees in natural stands and adding the capacity to model post-harvest and treated natural stands. In 2004 new height increment, DBH increment and mortality functions were re-fit for juvenile aspen and spruce and incorporated into MGM.

In early 2005, MGM 2005a was released in conjunction with a user workshop. The release of the model with new juvenile functions quickly underscored the difficulty in making long term, rotation length projections when there was insufficient data to support these types of projections. The new post harvest stand conditions were dramatically different (trees were larger much earlier due to silviculture) than early natural stand development which significantly changed how the mature models behaved. One of the undesirable results was significantly higher yields. Additionally, with the growing importance of alternative regeneration standards, the existing functions (lookup tables) to establish these young stands were inappropriate. This forced the team to focus on re-evaluating the mature growth and mortality functions and the regeneration dialogue. This was not planned under the existing project but was necessary before we could continue with other refinements needed to model silvicultural treatments. This proved to more difficult due to a severe lack of mid-rotation (20- 50 year old) data and the significant difference between early natural and post harvest stands.

On the other fronts a comprehensive validation process using actual data was developed and implemented to allow for quick evaluation of model performance for both juvenile and mature data. Another major initiative was the development of the multistrata model which permits modeling of complex spatially structured stands. This will enable us to effectively model heterogeneous stands and spatially structured silvicultural treatments such as strip cutting and understory protection. In 2005 the volume loss factor (VLF) project which was initiated to develop some preliminary volume loss factors or operational adjustment factors for MGM. Soon after the project began the significance of stand fragmentation was recognized and additional efforts were invested into improving our understanding of the role of fragmentation and heterogeneity of stands. New protocols are now being developed to quantify the magnitude of stand fragmentation and to develop correction factors for operational use.

Evaluating the predictive performance of several growth models calibrated for Saskatchewan

Cosmin Tansanu, Mike Bokalo and Phil Comeau

A two year project funded by the Saskatchewan Forest Centre, Forest Development Fund, Saskatchewan Environment - Forest Service, Weyerhaeuser Prince Albert, the University of Alberta and WESBOGY was initiated in 2004 to compare and evaluate the predictive performance of the following models:

- Saskatchewan Provincial Empirical Yield Curves, Golder and Associates Ltd, 2001.
- Dendron and Flewelling Growth models - Preliminary natural stand growth and yield estimation for Saskatchewan, 1995.
- Mixedwood Growth Model (MGM). S.J.Titus, University of Alberta

The general approach of the project was to use permanent sample plot (PSP) data to initialize each model and allow the models to project growth into the future following the re-measurement schedule of each PSP. We compared actual known growth of the permanent sample plots to the model predictions. The selected PSPs came from 3 pure strata (spruce, pine and aspen) and 2 mixed strata (conifer leading mixedwood and deciduous leading mixedwood). Both short and long term projections were used and model performance was assessed based on comparing predicted against actual volume(m3/ha), basal area(m2/ha), quadratic mean diameter (cm), height (m) and density (sph). Comparison methods included a paired t-test approach (predicted versus actual), using a general + or - 10% criteria of the actual and graphically.

The project was completed in February of 2005. The following are some of the conclusions drawn from the study for the three models.

The Saskatchewan yield curves were not constructed to predict “normal” stand development. They represent landscape level yields based on means, by age class, of temporary sample plots. Figure 1 illustrates the differences between the two populations (TSP versus PSP). All paired t-tests show that predictions were significantly different from actual with only 13 out of a possible 208 predictions being within ±10%.

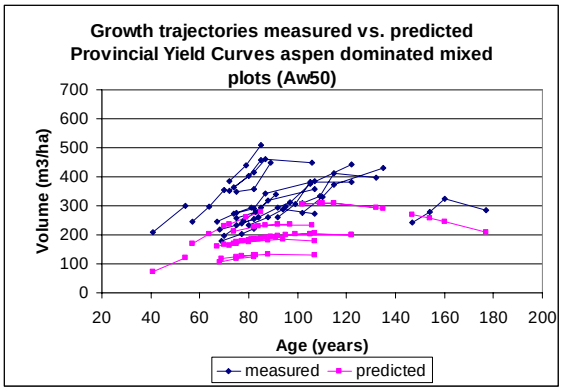


Figure 1: A comparison of the Saskatchewan provincial yield table predicted volume trajectories versus actual PSP volume trajectories for aspen leading mixedwood PSPs.

Flewelling's model was constructed using the same Saskatchewan PSPs used to evaluate its performance. For this reason it was expected to do well overall. The results show that this model provided the best overall predictions of stand characteristics and was least influenced by the input data. The main disadvantage was that the model always predicted growth similar to that of the PSPs (figure 2). This feature strengthened the precision in predicting PSP yield but restricts the model's ability to predict growth and yield of plots that are different from the traditional PSPs (ie. uneven-aged).

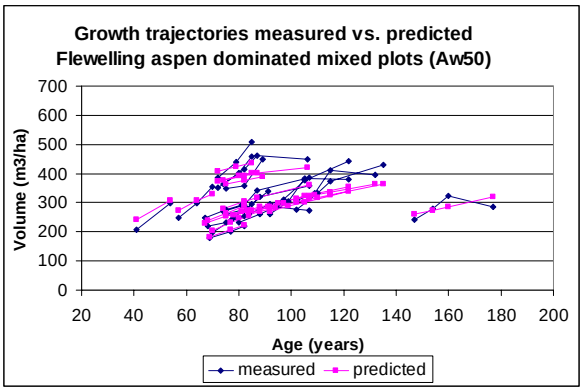


Figure 2: A comparison of Flewellings model predicted volume trajectories versus actual PSP volume trajectories for aspen leading mixedwood PSPs.

The Mixedwood Growth Model was the most versatile and flexible of the three models. In the case of predicting the yield of Saskatchewan PSPs, the model overestimated some of the PSP characteristics. The over predictions were related in part to the quality of the input data and in part to the internal functions (calibration). The questionable quality of the input refers specifically to two important inputs: *site index and stand age.* The strength of the model was that it was not restricted to predicting the "normal" growth of the PSPs but rather utilized actual plot conditions (site index, height, species composition and density) to determine height increments, diameter increments and mortality rates for the individual trees (figure 3).

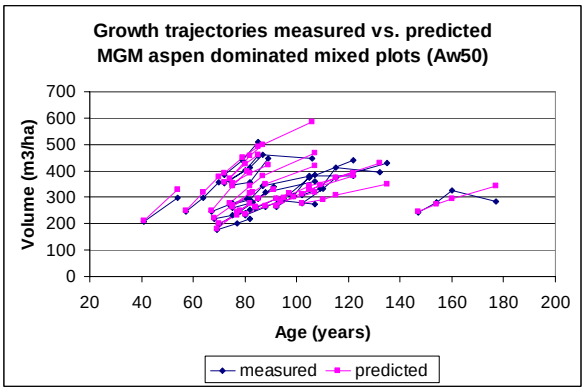


Figure 3: A comparison of MGMs predicted volume trajectories versus actual PSP volume trajectories for aspen leading mixedwood PSPs.

In general each of the models had its strengths and weaknesses and these are discussed in detail in the final report.

The report is available from the Saskatchewan Forestry Centre website: http://www.saskforestcentre.ca

Gradients in microclimate and spruce growth adjacent to young aspen stands

Mihai Voicu and Phil Comeau
University of Alberta, Department of Renewable Resources

Treating small patches or clusters of conifer, while leaving a portion of the stand untreated, is a potentially useful option for enhancing spruce growth and increasing spruce yield in regenerating mixedwood stands. However, an issue that is of concern is whether the taller surrounding aspen influence growth of the white spruce. Information on the nature and extent of these edge effects is of potential value in identifying optimal sizes for the spruce patches.

Data were collected during the growing season of 2002 and 2003 within three 12 year-old WESBOGY installations located near Grande Prairie and Peace River, Alberta. At these sites we examined how light, soil moisture and air temperature change across the boundary between young aspen and young spruce patches. We also examined how these factors influence white spruce growth adjacent to aspen patches.

Results from this study show:

- Light levels increase with distance from the aspen stands. The potential negative effects of adjacent aspen on tree growth are restricted to a narrow band less than 1/3 of a tree length in width;
- Soil moisture availability is highest in the conifer patch right at the edge of a north facing aspen stand;
- Young aspen patches provide spruce with some protection from growing season frost within one tree length from the edge of the patch.

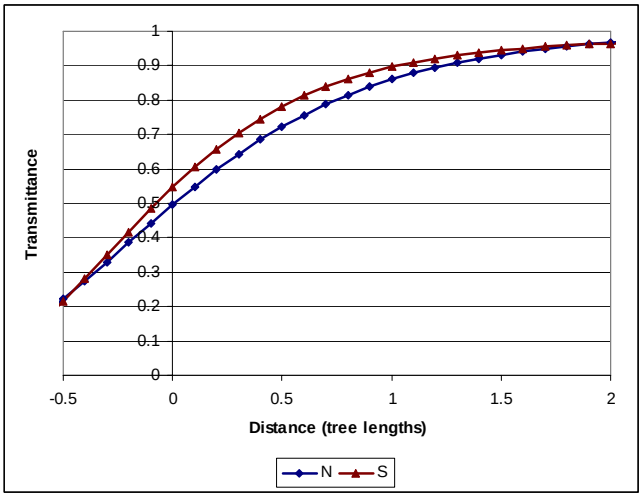


Figure 1. This graph shows the relationship between light (transmittance) at 1 m height and distance from the edge of 12 year old aspen stands for North (N) and South (S) facing edges. The lines are described by the equations:

North: $DIFN = 0.9987e^{-e^{-\left|\frac{PDD-0.2334}{0.6488}\right|}}$, p<0.0001, R2adj=0.88 n=162

South: $DIFN = 0.9768e^{-e^{-\left|\frac{PDD-0.2848}{0.5226}\right|}}$, p<0.0001, R2adj=0.86 n=245

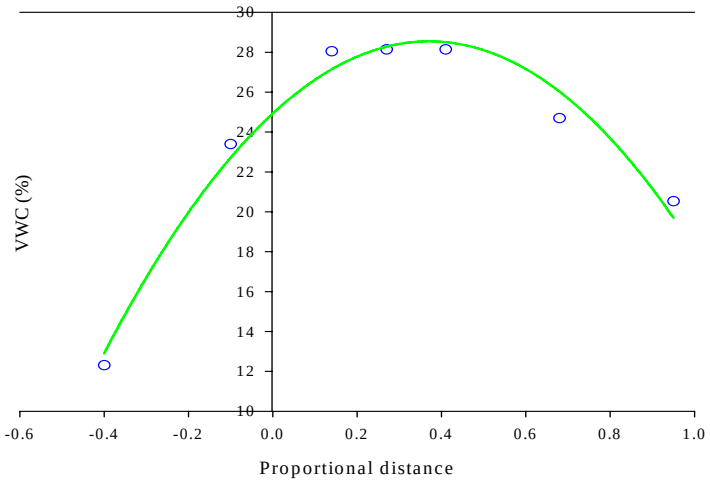


Figure 2. Relationship between volumetric water content (VWC) on July 31, 2003 and proportional distance at Hines Creek. Proportional distance is defined as the number of tree lengths from the N-facing edge of the aspen stand, with negative proportional distances indicating points inside of the aspen stand. The height of the adjacent aspen stand is 7m.

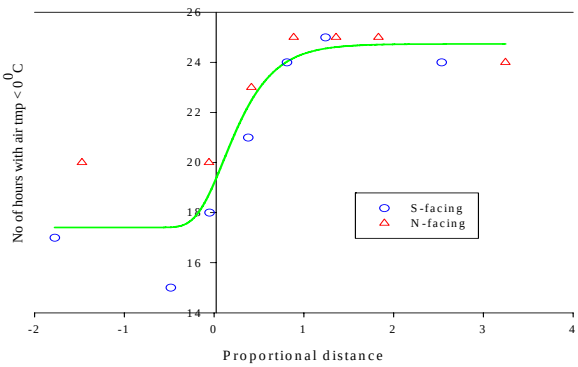


Figure 3. Frequency of summer frost in 2003 increased with distance from the edge of the aspen patch (Proportional Distance=aspen tree heights).

For more information see:

Voicu, M.F. 2005. Gradients in microclimate and spruce growth adjacent to young aspen stands. MSc Thesis. University of Alberta, Faculty of Graduate Studies and Research, Edmonton, Alta.

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

Competitive effects of woody and herbaceous vegetation in a young boreal mixedwood stand

Cosmin D. Man and Phil Comeau

Department of Renewable Resources, University of Alberta

The influence of aspen and herbaceous/grass vegetation on light, soil moisture, air temperature, soil temperature, soil nitrogen availability and white spruce growth was measured as part of a large, long-term experiment established near Whitecourt, Alberta in 2002. During the 2004 and 2005 growing seasons, we examined the effects of treatments designed to provide woody or complete vegetation control on leaf area index (LAI) of both the woody and herbaceous components and relationships between leaf area index of these components and light, soil moisture, air temperature, soil temperature, soil nitrogen availability or spruce growth. Results indicate that controlling only woody vegetation resulted in rapid expansion of the herbaceous layer.

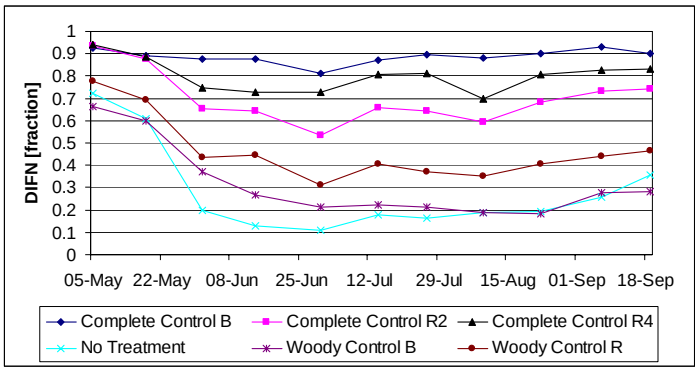


Figure 1. The treatments significantly changed light levels (difn=fraction of full sunlight) during the growing season of 2005. Complete control involved application of glyphosate herbicide to provide control of all vegetation with broadcast treatment involving repeated applications for 4 years, and R2 and R4 involving herbicide application during the first 2 and 4 years, respectively, in a 2 m radius spot centered on each spruce seedling. Woody control treatments involved application of triclopyr ester herbicide as a broadcast (B) (entire plot) or radial (R) (2 m radius around each spruce).

Treatments significantly changed leaf area index, seasonal patterns in light, and soil nitrogen availability. However, they did not significantly affect soil moisture due to large amounts of precipitation received on this site in 2004 and 2005. Soil nitrogen availability in 2005 was significantly higher in the broadcast complete control compared to all other treatments. Growth of the spruce seedlings was found to decrease with increasing aspen or grass LAI, with aspen apparently having a stronger effect per unit increase in LAI than grass.

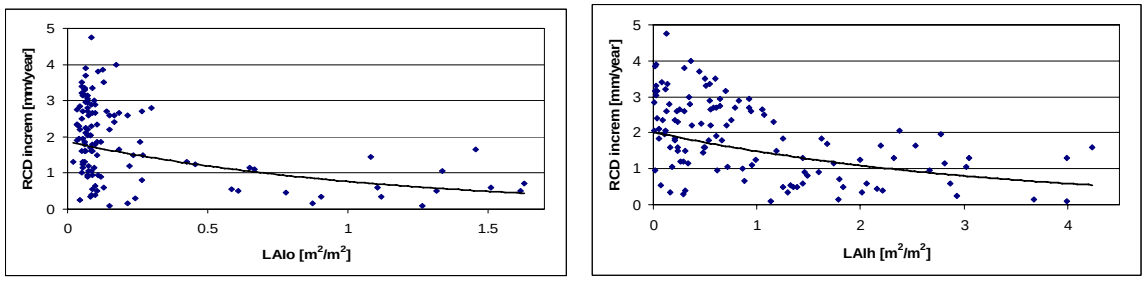


Figure 2. Relationship between root collar diameter increment (RCDincrem) in 2005 and Leaf Area Index of the aspen overstory (LAIo) and the grass/herb understory (LAIh). The line shows the relationship described by the equation:

$$RCDinc = 0.06135 \cdot InitH^{1.14154} \cdot e^{-0.88777 \cdot LAIo - 0.30797 \cdot LAIh},$$

InitH – Initial Height, LAIo – Overstory LAI, LAIh – Herbaceous Vegetation LAI. **R^2 = 0.4591**, R^2_{adj} = 0.4451, RMSE = 0.60725, *n* = 120. For the lines shown: 1) on the LAIo graph : LAIh = 1.21 m^2/m^2 and InitH = 25.79 cm (average values); 2) on the LAIh graph For the line shown, LAIo = 0.26 m^2/m^2 and InitH = 25.79 cm (average values).

Spot control, involving controlling all vegetation within a 2-m radius, while leaving 3 m of untreated between treated spots, is a promising alternative to classical broadcast treatments for establishing spruce in a mixedwood stand, at least for first 3 years after establishment.

For further details see: *Man, C.D. 2006. Competitive effects of woody and herbaceous vegetation in a young boreal mixedwood stand. MSc Thesis. University of Alberta, Faculty of Graduate Studies and Research, Edmonton, Alta.*

Graduate Students and their thesis project titles

Cosmin Filipescu (Ph.D.) - Effects of competition, site, and age on white spruce growth.

Dan MacIsaac (Ph.D) – Stand dynamics in young aspen-spruce mixedwoods.

Cosmin Man (M.Sc., completed April 2006) - Competitive effects of aspen and understory vegetation.

Francesco Cortini (M.Sc.) – Effects of red alder and paper birch competition on growth of young conifers.

Cosmin Tansanu (M.Sc.) – The role of gaps and stand fragmentation in estimating stand yields.

Sheelah Griffith (M.Sc.) – Characterization of plant community leaf area index and understory vegetation development following pre-commercial thinning in boreal mixedwood forests

WESBOGY Annual Fall Meeting
August 29 – September 1

Hosted by: Northwest Territories Resources, Wildlife and Economic Development
Theme: Wildlife and Growth and Yield

August 30th

8:30 —8:45 am **Welcome**

8:45 —12:00 am **Wildlife and Growth & Yield Presentations**

Lisa Smith/Andrew Cassidy and Paul Kitchen – NWT, Wildlife and Economic Development. *"Forest Management in the NWT"*

Paul Leblanc – Louisiana-Pacific, Swan River, Manitoba. "Habitat Element Curves: Wildlife meets Growth & Yield"

Mike Bokalo – University of Alberta. "Evaluating the forest growth model PROGNAUS and understory vegetation models for roe deer habitat predictions."

Wendy Crosina – Weyerhaeuser, Alberta. *"Managing Wildlife Habitat in Alberta: A Forest Management Perspective*"

1:00—4:00 pm **WESBOGY Research**

Graduate Student Research Presentations

MGM Development – Ken Stadt

Phil Comeau and Mike Bokalo – Ongoing Research

4:30—6:00 pm **WESBOGY Business Meeting**

August 31st

Travel to WESBOGY Installation by Bus—Break at Sambaa Deh Falls

Travel to Fort Simpson for accommodation and evening dinner

Sept 1st

Travel to Muskeg River Forest Demonstration Area in Fort Liard

Cooperative venture between the local Acho Dene Koe Band, RWED, and the Canadian Forest Service

The objective of this was to establish a demonstration for the local community and forest managers to display and monitor traditional use and advanced commercial forest management applications

Established in July 1994

It includes eight harvest patterns or systems in 14 cutblocks including clearcut, shelterwood, and selection harvesting.

58 silviculture research plots – various site preparation, regeneration and vegetation management treatments

11.5 kms of Interpretive trails with signs

Return trip home to Hay River—break at Lady Evelyn Falls

Planned WESBOGY Meetings in 2006

The 2006 Annual Spring Meeting is planned for April 26, 2006
The 2006 Annual Fall Conference, hosted by Louisiana-Pacific Canada Ltd., Dawson Creek is planned for August 29 to August 31st in Dawson Creek, B.C.

WESBOGY Website

With the assistance of Judy Jacobs (U of A, Department of Renewable Resources Webmaster / Multimedia Technician) our 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://www.wesbogy.rr.ualberta.ca/

Sambaa Deh Falls, NWT
Photo Credit: Phil Comeau

History of WESBOGY Meetings

Date	Sponsor	Location
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

Junction of the Mackenzie and Liard Rivers, Fort Simpson, NWT
Photo Credit: Phil Loseth

Financial Report for 2005/2006—Expenditures April 1, 2005 - March 31, 2006

Items	Budget	Actual
Salary and Benefits - Bokalo	$68,000.00	$69,686.19
Salary and Benefits - Data Management Support	$10,000.00	$12,368.28
Salary and Benefits - Annual Report and Web Site	$2,000.00	
Graduate Student Support and Field Travel	$15,500.00	$4,238.66
Supplies	$3,000.00	$6,759.75
Postage/Telephone	$2,000.00	$1,241.36
Travel & Meetings	$10,000.00	$11,057.51
Equipment (Computer)	$0.00	$0.00
University Overhead (15%)	$15,000.00	$15,000.00
Total	$125,500.00	$120,351.75
Revenues		
Member Dues	$100,000.00	$100,000.00
Balance at March 31, 2006	-$25,500.00	-$20,351.75
Opening balance (April 1, 2005)	$158,383.54	
Closing Balance (March 31, 2006)		$138,031.79

Projected Revenue April 1, 2006 – March 31, 2007

Alberta Sustainable Resource Development, Public Lands and Forests Division, Edmonton, Alberta	12,500
Alberta-Pacific Forest Industries Inc., Boyle, Alberta	12,500
Canadian Forest Products Ltd., Grande Prairie, Alberta	12,500
Daishowa-Marubeni International Ltd., Peace River, Alberta	12,500
Government of NWT, Forest Management Division, Hay River, NWT	12,500
Louisiana-Pacific Canada Ltd., Swan River, MB and Dawson Creek, BC	12,500
Manning Diversified Forest Products Ltd., Manning, Alberta	12,500
Saskatchewan Environment – Forest Service	12,500
Alberta Plywood, Slave Lake, Alberta	12,500
Weyerhaeuser Canada, Alberta and Saskatchewan	12,500
Total revenue	**125,000**

Description	Amount
Personnel:	
1. Research Scientist (including benefits)	$70,000.00
2. Graduate student stipend and/or independent research projects	$15,000.00
3. Field and office technical support	$12,000.00
Travel, subsistence, and accommodation	$7,000.00
Computer software, equipment, maintenance	$5,000.00
Overhead (15%)	$16,000.00
Total	**$125,000.00**

Member Contact Information

Company or Agency	Contact	Email
Alberta Sustainable Resource Development	Dave Morgan (780) 422-5295 Daryl Gilday (780) 422-5257	Dave.Morgan@gov.ab.ca Daryl.Gilday@gov.ab.ca
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Daishowa-Marubeni International Ltd.	Gary Whittaker (780) 624-7232 Florance Niemi (780) 624-7048	Gwhittaker@prpddmi.com Fniemi@prpddmi.com
Louisiana-Pacific Canada Ltd., Manitoba	Paul Leblanc (204) 734-7724 Ken Broughton (204) 734-4102	Paul.Leblanc@lpcorp.com Ken.Broughton@lpcorp.com
Louisiana-Pacific Canada Ltd., Dawson Creek	Christy Nichol (250) 782-3302 ext 223 Rod Brooks (250) 782-3302 ext 239	Christy.Nichol@lpcorp.com Rod.Brooks@lpcorp.com
Manning Diversified	Andy Shandro780-836-3111 J.P. Beliech780-836-3111	Andy.Shandro@mdfp.ca Jp.bielech@mdfp.ca
Northwest Territories Resources, Wildlife and Economic Development	Paul Kitchen (867) 874-2009 Lisa Smith 867-874-2009	Paul_Kitchen@gov.nt.ca Lisa_Smith@gov.nt.ca
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Alberta Plywood Ltd. A Division of West Fraser Mills Ltd	Gary Harmata (780) Gordon Sanders (780)	Gharm@westfrasertimber.ca Gordon.Sanders@westfraser.com
Weyerhaeuser Company, Alberta Forestlands	Greg Behuniak (780) 539-8207 Wendy Crosina780-451-9783	Greg.Behuniak@weyerhaeuser.com Wendy.Crosina@weyerhaeuser.com
Weyerhaeuser Company, Saskatchewan Forestlands	Dave Lindenas (306) 953-5154	Dave.Lindenas@weyerhaeuser.com

Notes

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University of Alberta
751 General Services Building
Edmonton, Alberta T6G 2H1

Phone: 780-492-4413
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www.wesbogy.rr.ualberta.ca

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