The purpose of this Annual Progress Report is to communicate progress and achievements of your research project over the funding period and identify impacts or outcomes of the project. Information from this progress report is required to assess the final progress of the project in relation to the Recipient Agreement and to provide information required for FII Ltd. to report on annual achievements and funding investments for the Forest Research Program. Complete the required information in the unshaded text boxes for **Parts A to C**, (text boxes will expand).

Part A: General Project Information

The information provided under Part A will be available for immediate posting on the Internet in a project repository on the Natural Resources Information Network (NRIN) website.

Project No:	R04-095 (Umbrella Letter of Agreement)
Organisation:	Ministry of Forests (MoF) Research Branch
Project Contact:	George Harper P.Ag., R.P.F.
Address:	1st Flr. 722 Johnson Street, P.O. Box 9519 Stn. Prov. Govt. Victoria, BC V8W 9C2
Phone No.	250-387-8904
Email:	George.Harper@gems4.gov.bc.ca
Project Title: Modelling the yield impact of variable retention harvesting, and the growth of aspen and birch	
Final Project Abstract:	
We continue to expand the yield projection capabilities of the Tree and Stand Simulator (TASS) through the addition of the two broadleaf species, trembling aspen and paper birch. We have also enhanced TIPSY through the development of a variable retention (VR) harvesting simulation system. The addition of VR to TIPSY, will be widely distributed to forest practitioners during 2004. These enhancements will also position TASS and TIPSY software for future modelling of mixedwood and complex stand partial harvesting prescriptions and integration with other research into root disease and wildlife habitat. The expanded capabilities of our system of models will continue to provide new information in support of decisions related to silviculture prescriptions and timber supply planning.	
Keywords:	
Growth, Yield, Aspen, Birch, Variable retention, TASS, TIPSY, Silviculture, Density management, Timber supply	

Part B: Project Impacts, Outcomes, Progress, and Extension

Information provided in Part B is used to evaluate and assess the completion of the project in relation to the terms and workplan outlined in the Recipient Agreement and assess the impacts and outcomes of the project.

B1: Workplan and Annual Progress Summary:

Using the table below, describe the extent to which the activities and objectives identified in the workplan (Schedule A Recipient Agreement) were achieved. Indicate any changes from the original plan in bold, and indicate date of approval and brief rationale for the change. Please list extension activities and deliverables in table B5 below("**Outputs, Deliverables, and Extension"**)

Project Component or Objective	Activities (Tasks)	Extent to Which Activities have been Completed and Objective has been Achieved
Modelling the impact of variable retention harvesting	Derive edge length estimation functions for Douglas-fir, western hemlock, lodgepole pine and white spruce.	New edge length estimation methodology for variable retention harvesting completed. Edge length estimation functions for Douglas-fir, Western hemlock, Lodgepole pine and white spruce completed.
	Validation and calibration of edge length function.	Testing and refining of coefficients completed.
	Incorporation of edge length functions into TIPSY.	Incorporation of edge length functions into TIPSY completed. Win TIPSY and Batch TISPY prototypes awaits Beta testing by select user group.
	Preparation of extension note on variable retention harvesting	Extension Note completed: DiLucca, M.C., J.W. Goudie and S.C. Stearns-Smith. 2004. Variable Retention Yield Adjustment Factors in TIPSY. B.C. Min. of For.,Victoria, B.C. Extension Note 69.

	Preparation of a journal paper on the yield implications of variable retention management.	Draft of journal paper completed. Internal review and approval stage.
	Variable retention presentations to key audiences	Presentations made to several key clients.
Modelling the growth and yield of aspen (*Populus tremuloides* **Michx.**).	Determine TASS II aspen tree level growth coefficients.	TASS II aspen tree level growth coefficient determinations completed.
	Complete aspen stand level data set and process to in-house standards.	PSP data obtained from 10 provincial and federal sources. All data summarized to in-house standards.
	Prepare a report summarizing the stand level data.	Summary report completed. *Please Note: Data Use Sharing Agreements prevent the circulation of this document.*
	Develop TASS II stand level density relationships for aspen.	TASS stand level density relationships for aspen developed.
	Adjust TASS II aspen results by comparing to stand level data summaries.	TASS aspen compared to stand level data summaries. First approximation results completed.
	Test operational limitations of TASS II aspen model and report aspen model strengths and weaknesses	TASS first approximation results assessed. Discussion of model issues and limitations found in summary report.
Modelling the growth and yield of birch (*Betula papyrifera*).	Compile, Analyze and Report on stand level data	Acquired and summarized paper birch plots from the following data sets: BC Ministry of Forests Growth Natural plots BC Ministry of Forests temporary inventory plots BC Ministry of Forests research plots (EP 1081 Birch thinning trial)

		Province of Quebec – permanent sample plots Summary is included in the final report.
	Measure, Analyze and Report on tree-level data.	Acquired and summarized detailed crown and bole information for paper birch in BC from data previously collected by Adams Lake Lumber, the BC Ministry of Forests (stand reconstruction), and M. Utunen (Univ. Helsinki) Summary is included in the final report.
	Calibrate and Test TASS-II for birch and Report on calibration and testing	Estimated parameters for key TASS functions and first approximation calibration completed. Initial testing completed. Final report includes data analysis and results of initial testing.

B2: Research Question:

Restate the research question as per your original proposal and comment on the extent to which your research question has been answered during the current funding period.

What are the yield capabilities of aspen and birch, and the yield impact of variable retention harvesting – and how will they affect the value, sustainability and marketability of timber products?

Currently TASS output (via TIPSY) is widely used for allowable annual cut determinations (managed stands) in BC. It is also being used to determine the economic impacts of various management alternatives by predicting their influence on timber yield and quality. TASS / TIPSY can be used for any decisions requiring managed stand yield tables (e.g. timber supply analysis, development of silviculture strategies, development of stand management guidelines, habitat supply decisions).

In the future, as a result of the work completed here and from other research initiatives, TASS / TIPSY will be able to predict the impact of current management decisions for aspen, birch and variable retention harvesting.

B3: Impacts and Outcomes:

Describe the impacts and outcomes of the research and how the research has benefited or improved sustainable forest management. Where possible, provide quantifiable outcomes associated with this research (i.e., volume gain in terms of m^3; cost savings due to improved access, etc.).

The outcomes of this project will benefit sustainable forest management by improving the ability to model the impacts of variable retention harvesting and, the growth & yield of aspen and birch.

The new modelling capabilities will provide resource managers with reliable decision support tools – ones that will address urgent issues. For example, the long-term yield ramifications of variable retention harvesting prescriptions. Also, aspen and birch modelling capability will provide end users such as Government, Private Industry and First Nations the tools to help evaluate density management options. Native hardwood species have historically been under-utilised and under valued. Hardwood modelling capability will promote sustainable management of our hardwood resources and promote growth and diversity in the forest industry.

B4: Users and Application of Results:

List the user group and describe the realised or expected benefit of your research (eg, researchers, technical experts, planners, foresters, practitioners, regulators, decision makers, public). If results or information derived from the research have been used, provide the name of the individual and organisation and describe how the information has been applied.

User/User Group	Realised/Expected Benefit
Timber supply planners	Expected benefits of TASS aspen, birch and VR growth & yield information include reduced uncertainty in terms of timber supply estimates.
Regulators	TASS / TIPSY will be used to explore and assess the implications of hardwood or VR policy, stocking standards and guidelines.

B5: Outputs, Deliverables, and Extension

List the deliverables or extension products developed from the research during the 2003/04 funding period. Please identify a) the type of deliverable (TYPE), b) the deliverable citation, and c) whether it is (Y) or is not (N) included as part of this Annual Progress Report submission (INCL).

TYPE	CITATION	INCL (Y/N)
TEC	VR technical report: "Development of variable retention adjustment factors (VRAF) for coastal Douglas-fir, western hemlock, lodgepole pine and white spruce" is presented as a draft paper to be submitted to a refereed journal. A cover letter is attached to notify FII not to post this report.	Y
TEC	Trembling aspen technical report: "Tree and Stand Simulator (TASS) Calibration - Stand Development & Mortality for *Populus tremuloides*." A cover letter is attached to notify FII not to post this report.	Y
TEC	Paper birch technical report: Calibration of TASS for paper birch: data analysis and initial calibration. ." A cover letter is attached to notify FII not to post this report.	Y

ORA	April 16, 2003 Silviculture treatments for ecosystem management in the Sayward (STEMS) Variable Retention (VR) Field Tour at Campbell River , including Ministry staff and BCIT students graduating class. Campbell River, BC	**N**
ORA	April 25, 2003 VR presentation given at the workshop "The Ecology and Silviculture of Variable Retention in Coastal Forests" in Nanaimo, Organized by Interfor West Coast Division and Madrone Environmental Services Ltd. Nanaimo, BC	**N**
ORA	May 9, 2003 VR modelling research work discussions with Nick Smith (Weyerhaeuser Co.) regarding applications on TFL39 and TFL44. Victoria, BC	**N**
ORA	May 16, 2003 STEMS VR tour at Campbell River, including Ministry Executive (Chief Forester), Industry, University, and Colleges representatives. Campbell River, BC	**N**
ORA	May 29, 2003 TASS VR modelling presentation at the Windthrow Workshop organized by Steve Mitchell at UBC, Vancouver, BC.	**N**
ORA	July 3, 2003 TASS VR modelling presentation delivered by Jim Goudie at the Western Mensurationists Annual Meeting, Victoria, BC.	**N**
ORA	November 19, 2003 TASS VR presentation given at the FERIC Regeneration Issues in Partial Cutting Workshop, Campbell River	**N**
EXT	LINK-FORREX Fall 2003 Issue article related to the status of variable retention research presented at the workshop "The Ecology and Silviculture of Variable Retention in Coastal Forests" in Nanaimo, Organized by Interfor's West Coast Division and Madrone Environmental Services Ltd. Pages 8, 9, 12, & 13.	**N**
ORA	March 1-3, 2004. Poster presentation at the 2004 Southern Interior Siviculture Committee (SISCO) titled "How TIPSY grows stands following variable retention harvesting". Penticton, BC.	**N**
EXT	DiLucca, M.C., J.W. Goudie and S.C. Stearns-Smith. 2004. Variable Retention Yield Adjustment Factors in TIPSY. B.C. Min. of For.,Victoria, B.C. Extension Note 69. http://www.for.gov.bc.ca/hfd/pubs/Docs/En/En69.htm	**Y**
OTH	TASS first approximation yield information for aspen & birch, VR incorporation into Win TIPSY and Batch TISPY prototypes.	**N**

Deliverable Type Legend

TYPE	OUTPUT DESCRIPTION	TYPE	OUTPUT DESCRIPTION
TEC	Technical Report	FGM	Field Guide or Manual
JOU	Peer Reviewed Journal Article	ORA	Oral Presentation
EXT	Extension Note or Newsletter Article	POS	Poster Presentation
NEW	Newsletter	WEB	Website
BOK	Book or Book Chapter	OTH	Other

Part C: Additional Project Information

Information provided in Part C will be used to report out on the overall investments of the Research Program during the 2003/04 funding period.

C1: Multi-year Projects: If the project is part of a multi-year research initiative, indicate in the statement below where the current funding period (2003/04) lies within the longer term research program:

The 2003/04 fiscal period represents year _____ of a _____ year research program/project.

C2: Research Focus: Select (by placing an X in the preceding box) the primary category that would best categorize the focus of research

	Silvicultural Systems - (harvesting systems – shelterwood, clear-cut, etc.)		Natural Disturbance Dynamics (fire, wind, etc.)		Site Rehabilitation and Restoration
X	Growth and Yield (modelling, site index work)		Ecosystem Dynamics (classification, inventory, PEM, ecosystem research)		Forest Genetics
	Biodiversity/Habitat Management (SAR, habitat requirements, habitat supply modelling)		Wood Quality (assessment, wood properties and potential applications)		Other – Please specify
	Forest health (pests and pathogens)		Soil Conservation, Health, and Productivity		
	Riparian and Aquatic Management (buffers, CWD)		Integrated Resource Management (land use planning)		

C3: Biogeoclimatic Ecosystem Classification: Identify (by placing an X in the preceding box) the BEC zone(s) to which the research applies.

	Alpine Tundra	X	Engelmann Spruce-Subalpine Fir	X	Ponderosa Pine
X	Boreal White and Black Spruce	X	Interior Cedar-Hemlock	X	Spruce-Willow-Birch
X	Bunchgrass	X	Interior Douglas-Fir	X	Sub-Boreal Spruce
X	Coastal Douglas-Fir	X	Montane Spruce		Not applicable
X	Coastal Western Hemlock	X	Mountain Hemlock		

C4: FII's Objectives and Strategies: With respect to FII's objectives and strategies listed below, identify (by placing an X in the preceding box) which of the following strategies best represents the overall objective and approach of your research project.

	Objectives and Strategies
	Objective: To support more effective policies, regulations, and guidelines
X	Support policy, regulatory and guideline development, evaluation and adjustment
X	Enhance quality of decision making through improved knowledge base
X	Empowered decision makers to employ practical adaptive management approaches
X	Support greater certainty in planning and decision making for all forest resources values
	Objective: To enhance the value of timber and forest land assets
X	More effective and efficient use of forest resources
	Reducing costs of timber production
	Reducing forest health risks through improved management practices
	Enhancing timber quality and resulting products
X	Increasing available volume and value through productivity enhancements, increased utilisation and better realisation of inherent site potential
	Increasing available timber volume through management of access constraints
	Objective: To improve stewardship and market acceptability of BC forest practices and forest products
X	Promoting new or adapted forest practices which give BC an edge in the world forest product marketplace
X	Improving sustainable forestry practices in terms of planning, management, monitoring, analysis, reporting and adjustment
	Enabling and accelerating certification practices