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 (Ref.No. R04-022)
Organisation:	Research Branch, Ministry of Forests
Project Contact:	Abdel-Azim Zumrawi
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Phone No.	(604) 822-1475
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Project Title: Implementing a Prognosis[BC] Regeneration Submodel for the Complex Stands of Southeastern and Central British Columbia	

Final Project Abstract:

Forests are dynamic ecosystems and are rarely in equilibrium. This is due to natural and anthropogenic disturbances. Harvesting constitutes one of the major anthropogenic disturbances. Regeneration is a crucial component of stand development cycle and constitutes the most important phase when exploring management options and silvicultural alternatives. The primary objective of this work is to develop a natural regeneration model for Prognosis[BC]. The specific objectives are to validate the regeneration model using data from the moist wet Interior Cedar-Hemlock (ICHmw2) subzone variant in the Nelson vicinity and other sources of data, and to select and evaluate the choice of predictor variables.

The most similar neighbour (MSN) approach was used to predict regeneration for Interior Cedar Hemlock (ICH), Interior Douglas-fir (IDF), and Montane Spruce (MS) biogeclimatic ecosystem classification (BEC) zones in southeastern and central of British Columbia. Data used in this analysis were previously collected from the dry cool MS (MSdk), the very dry mild IDF (IDFxm), the

ICHmw2, dry cool IDF (IDFdk1, IDFdk1, IDFdk2, IDFdk3, and IDFdk4), and the dry mild IDF (IDFdm2) subzone variants.

Data collected from 122, 350, and 556 plots for the MS, ICH, and IDF zones, respectively were used in this study. About 20 % of sampling was carried out on undisturbed and clear-cut sites and the remaining 80% on harvest sites with different retention levels. The plots provide different ranges of residual basal area, number of residual trees, and site factors such as aspect, elevation, geographic locations, and site series. Descriptive analyses indicate that regeneration was highly variable within the study areas and that species composition reflected pre-harvested conditions. Averages regeneration of 9141, 6559, and 2238 stems per ha were found on the sites of the ICH, MS, and IDF respectively. Zonal sites had the highest natural regeneration densities.

Within each zone, the MSN made use of the plots that have both regeneration and site and overstory information (called reference plots) to predict regeneration of the plots that have site and overstory information but assumingly lack regeneration information (called target plots) by selecting the most similar plot. The performance of the four MSN models used to predict regeneration of three shade tolerant species groups by four height classes was comparable. However, the predictions of the MSN model that included the aspect as a class variable among its set of auxiliary variables were superior.

Keywords:

Prognosis[BC], Natural Regeneration, partial-harvesting, Growth and Yield, Modelling

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
Validate the regeneration model using independent data from the ICHmw2 subzone in the Nelson forest region and other sources of data	- Data cleaning, formatting and summary. - Factor analysis. - Conduct Most Similar Neighbour (MSN) runs. - Summarize results.	Completed.
test and evaluate the performance and efficiency of the prototype model	- The prototype regeneration database updated and tables corrected. - New forms for new data acquisition were added to the relational database.	Completed.
Make all the necessary programming and database design changes based on the results from 1 and 2 above	Code and database design changes.	Completed.

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.

How natural regeneration may be predicted in the uneven-aged, multi-species complex stands of the southern and central interior, using imputation techniques within the context of the Prognosis^{BC} model?

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 primary objective of this research is to develop a natural regeneration prediction tool for use with the *Prognosis^{BC}* growth and yield simulator. However, the system developed is flexible and could be adapted for use with other growth and yield models.

This research identified the key predictor variables for modelling natural regeneration using imputation techniques, validated the model behaviour and completed the development of the natural regeneration database for the Interior Cedar Helmock (ICH), the Interior Douglas Firn (IDF) and the Mountane Spruce (MS) zones. The impacts of this work will materialize when the model becomes operational following the 3rd and final year of its development (04 / 05). It will then provide a tool for researchers and planners that will enable them to project future stand development with a degree of certainty in the amount and composition of natural regeneration following partial harvesting or other stand disturbances.

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

Researchers	Provide a tool that will enable researchers to study the impact of various management options and silvicultural alternatives on future stand dynamics of complex stands..
Planners and Foresters	Provide a tool that will aid sound planning by providing reliable predictions of natural regeneration.
Decision Makers	Provide tools to assist in formulating policies for selection harvesting to satisfy requirements for non-timber resources; and providing tools that will enhance long-term projections of the inventory, and provide data for the purpose of AAC determination in areas under uneven-aged management

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)

ORA	• Natural regeneration and juvenile height growth models for partially cut complex stands of southeastern and central BC.
	    Presented at the "Regeneration Issues in Partial Cutting" Workshop organized by FERIC, Kelowna, BC October 28, 2003.
	        http://www.feric.ca/en/wd/	

ORA	• Natural regeneration and juvenile height growth models for partially cut complex stands of southeastern and central BC .
	    Presented at the "Regeneration Issues in Partial Cutting" Workshop organized by FERIC, Edmonton, AB November 13th, 2003
	        http://www.feric.ca/en/wd/	

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 (modeling, site index work)		Ecosystem Dynamics (classification, inventory, PEM, ecosystem research)		Forest Genetics
	Biodiversity/Habitat Management (SAR, habitat requirements, habitat supply modeling)		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		Engelmann Spruce-Subalpine Fir		Ponderosa Pine
	Boreal White and Black Spruce	X	Interior Cedar-Hemlock		Spruce-Willow-Birch
	Bunchgrass	X	Interior Douglas-Fir		Sub-Boreal Spruce
	Coastal Douglas-Fir	X	Montane Spruce		Not applicable
	Coastal Western Hemlock		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
	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