Lodgepole Pine Regeneration Model Deployment and Enhancement Plan

Introduction

The long-term FGYA Regenerated Lodgepole Pine (RLP) Project was designed to forecast and monitor the growth of harvest-origin lodgepole pine, in relation to site quality, planting density, natural regeneration, mortality, vegetation management and thinning. In the shorter-term the main focus of the project is to provide an improved basis for achieving reforestation performance targets.

The lodgepole pine regeneration model, based primarily on data from the RLP Project, predicts regeneration performance at stand ages up to (currently) 12 years, from earlier establishment conditions, treatments and surveys. In addition to forecasting reforestation success relative to regeneration targets and standards, it can be linked to conventional growth and yield models in order to estimate yields at rotation. It is also being used to assist in the development of a decision support tool predicting stand development following MPB attack and salvage.

The workshop *Decision Support Tools for Management of Regenerated Lodgepole Pine* held in Hinton June 17, 2010, identified three main priorities for action to support forest management by FGYA members:

1. Deployment and enhancement of the MPB decision support tool to assist managers assess the impact of MPB infestation, and various silvicultural interventions, on post-attack stand development;
2. Deployment and enhancement of the RLP regeneration model for predicting post-harvest stand development;
3. Initiation of a silvicultural risk management discussion group to develop awareness, knowledge and consensus for addressing silvicultural threats, primarily mountain pine beetle and other climate-related trends resulting in increased mortality of lodgepole pine.

The first priority is being achieved under a separate deployment plan and web application for the FRI MPB Decision Support Tool Project.[1] The second priority will be addressed under the RLP Project and the deployment plan detailed below. The third priority will be addressed by both projects, with discussion and feedback on MPB-related threats facilitated by the MPB DST web application, and on other mortality threats by a RLP Project web forum (see below). Possible organization of a more formal and consolidated risk management discussion group will be reviewed after further feedback following deployment of both the MPB tool and the RLP model.

[1] For access by registered users, or to request access, go to: http://mpbdst.encaps.com/

Roles and Responsibilities

- Policy and executive management (Bob Udell – FGYA Director):
  - Approve users;
  - Approve materials (models, documentation, data, event notifications etc.) for release to users;
  - Oversee project implementation and administrative and financial arrangements.
- Administration, communications and extension (Sean Kinney FRI, Sharon Meredith SRD):
  - Create user accounts for approved users;
  - Communicate passwords, user access, etc.;
  - Trouble shoot web access issues;
  - Respond to administrative and access questions from registered users;
  - Organize user events (meetings, workshops, web seminars and / or field visits etc.).
- Research and development (Dick Dempster – FGYA Research and Development Associate):
  - Research and develop model and applications, including incorporation of new data, user-feedback and testing;
  - Provide documentation for models and related research;
  - Respond to technical growth and yield questions from users;
  - Facilitate web-based discussion of management implications among users;
  - Make recommendations to Director for release of research materials and participation of additional users.

Deployment and Enhancement Strategy

Users and Access

Until development and testing are complete, distribution of the regeneration model will be limited to identified first-round users (see Table 1) or their designates. Exceptions may be made for other organizations willing to assist in model development and related research. Users may be designated from such organizations subject to approval by the FGYA Director and Chairperson.

First-round users may designate as many other users as they wish, subject to any additional user being:

1. An employee of the FGYA member organization represented by the first-round user;
2. Willing to assist in testing the model and / or provide other feedback for its enhancement, by participating in the RLP discussion group (see below).

Users will be provided with a username and password giving them web access to a *SharePoint* service from which they can download models and documentation, and where they can post questions, comments and other feedback.

The model and other downloads will not require any special installation, and may be run on any computer that already has Microsoft *Office* and *Excel* installed.

Table 1. Agency Contacts and First-Round Users

Affiliation	First Name	Last Name	Telephone	E-mail
Alberta Sustainable Resource Development	Robert	Stokes	(780) 422-2690	robert.stokes@gov.ab.ca
	Dave	Morgan	(780) 422-5295	dave.morgan@gov.ab.ca
	Daryl	Price	(780) 422-0329	daryl.price@gov.ab.ca
	Sharon	Meredith	(780) 865-8379	sharon.d.meredith@gov.ab.ca
ANC Timber	Greg	Branton	(780) 778-7012	gregb@albertanewsprint.com
	Peter	Winther	(780) 778-7000	peterw@albertanewsprint.com
Blue Ridge Lumber	Tim	Burns	(780) 648-6220	tim.burns@westfraser.com
	Colin	Scott	(780) 648-6200	colin.scott@westfraser.com
Canfor	Dwight	Weeks	(780) 538-7745	dwight.weeks@canfor.com
	Melonie	Zaichkowsky	(780) 538-7720	melonie.zaichkowsky@canfor.com
	Rob	McLaughlin	(780) 538-7737	rob.mcLaughlin@canfor.com
Foothills Research Institute	Debbie	Mucha	(780) 865-8290	dmucha@foothillsri
	Sean	Kinney	(780) 865-8329	skinney@foothillsri
Hinton Wood Products	Richard	Briand	(780) 865 8181	richard.briand@westfraser.com
	Glenn	Buckmaster	(780) 490-2307	glenn.buckmaster@westfraser.com
Millar Western	Tim	McCready	(780) 778-2221	tmcready@millarwestern.com
Spray Lakes Sawmills	Ed	Kulcsar	(403) 932-2234	ed.kulcsar@spraylakesawmills.com
	Daryl	Kelley	(403) 932-2234	daryl.kelley@spraylakesawmills.com
Sundance Forest Industries	John	Huey	(780) 723-3977	john.huey@sundanceforestindustries.ca
	Pat	Golec	(780) 723-3977	pgolec@sundanceforestindustries.ca
Sundre Forest Products	Bob	Held	(403) 638-4482	bob.held@westfraser.com
Weyerhaeuser Canada	Greg	Behuniak	(780) 539-8207	greg.behuniak@weyerhaeuser.com
	Tim	Gylander	(780) 733-4206	tim.gylander@weyerhaeuser.com

Documentation

User instructions and detailed documentation of the modelling system will be made available to registered users for downloading from the web *SharePoint* site. Documentation is currently available for the preliminary model versions already demonstrated to FGYA members and other participants of the June 17 workshop, and will be updated for each round of model enhancement. Relevant reports, scientific papers and interim technical notes describing the RLP trial results and related research will be posted for downloading from the same *SharePoint* site. They will also be placed in the public domain on the Foothills Research Institute website.

Testing and Feedback by Users

There are limited opportunities for testing the model and comparing the RLP trial results against other controlled experimental trials. However, there are plenty of opportunities for comparing model predictions with results from industrial regeneration surveys, where openings have been surveyed more than once since harvest (e.g. stocking and / or establishment surveys followed by performance surveys conducted according to RSA procedures).

Users will be encouraged to test the model against their own operational RSA data. Two preliminary demonstration models were developed, one for planted stock and one for natural regeneration. In order to facilitate testing, these will be consolidated into one combined model, and inputs and outputs will be made more compatible with operational regeneration survey data.

Discussion Group

A password protected *SharePoint* service will facilitate:

- Access to models and documentation;
- Questions, answers, trouble-shooting;
- Feedback: observations, results and interpretation of tests, interpretation and implications of predictions, required model enhancements, prioritization of research effort;
- Notifications: events, updates, relevant research developments and publications.

The discussion group will be hosted by FRI and will utilize the Institute's existing IT structure and *SharePoint* service. Questions will be answered in a timely manner, usually within 24 hours and with a target maximum response time of two working days.

Continual Improvement

The RLP Project was designed to provide forecasts of regeneration performance and stand development, followed by long-term monitoring of actual performance so that initial forecasts can be continually improved as results become available. This principle will be maintained in deployment and enhancement of the models. Several rounds of enhancement are identified below, and these will be followed by on-going annual updates until 2014, by which time most installations will have reached a stand age of 14 years since harvest (currently the maximum age for RSA performance assessment).

If it is demonstrated that at age 14 the regeneration model projections can be replaced by projections using a conventional growth and yield model, then current trial re-measurement procedures will be adjusted to focus on monitoring growth and yield during the growth phase (the period between completion of regeneration establishment and final harvest). Alternatively, if it is found necessary to extend the regeneration model beyond 14 years, the trial measurements and model updates will be continued for an extended transition period, retaining the current measurement procedures designed for tracking stand development during the regeneration phase.

Deployment and Enhancement Schedule

Preliminary Demonstration and Deployment

Preliminary models (*RLPp_v1alpha* and *RLPn_v1alpha*) were distributed to FGYA members April 7, 2010. The models were demonstrated at the June17 workshop, including an added feature linking mortality of planted stock to mean annual temperature. Documentation was sent to participants prior to the workshop.

Completion date: June 17, 2010.

First Round – Model Consolidation and Discussion Group Formation

Designated users will be provided access to the models, documentation and *SharePoint* service, and invited to participate in testing of the consolidated model and discussion of related issues.

Appendix 1 contains a summary of priorities identified by workshop participants. The highest priority for development and testing of the regeneration model is to consolidate and re-format the separate plantation and natural regeneration versions into a single model that can accept and predict data for any combination of planting and natural ingress, compatible with RSA surveys. This will be undertaken prior to further model development or testing.

Completion date: October 31, 2010.

Second Round – Incorporation 2010 Data and Feedback

On completion of measurements being conducted during the 2010 field season, detailed data to 9 years following planting will have been collected on all plots in the RLP trial, and the majority of plots will have been monitored for 11 years or more since harvest. These data will greatly advance the basis for prediction of treatment responses and for projecting results to RSA performance survey age (12 – 14 years since harvest).

A second-round update of the model and documentation will be produced incorporating the new data, focusing on treatment scenarios of primary interest to members (see Appendix), and any feedback received from the first round release and testing. The regeneration model output will be adapted to facilitate rotation-age MAI estimation by GYPSY or other growth and yield models, depending on tests currently being made of GYPSY predictions against long-term site-replicated spacing trial data.

Completion date: March 31, 2011.

Third Round – Incorporation of 2011 Data and Feedback

Additional model validation and enhancements will be made possible by the following activities.

- User testing of the model against RSA data will be encouraged and, if requested, assisted.
- Field measurements of all RLP installations are scheduled for 2011, and will result in the majority of plots having been monitored for 12 years since harvest, thus bridging the entire regeneration phase from harvest to minimum performance assessment age.
- Selected RLP installations, and possibly RSA surveyed blocks used or model testing, will be the subject of a field tour and expert inspections during the summer of 2011.
- All feedback received from users will be reviewed;
- Analyses, literature review and group discussion of climate effects will be continued.

Completion date: March 31, 2012.

On-going Updates and Enhancements

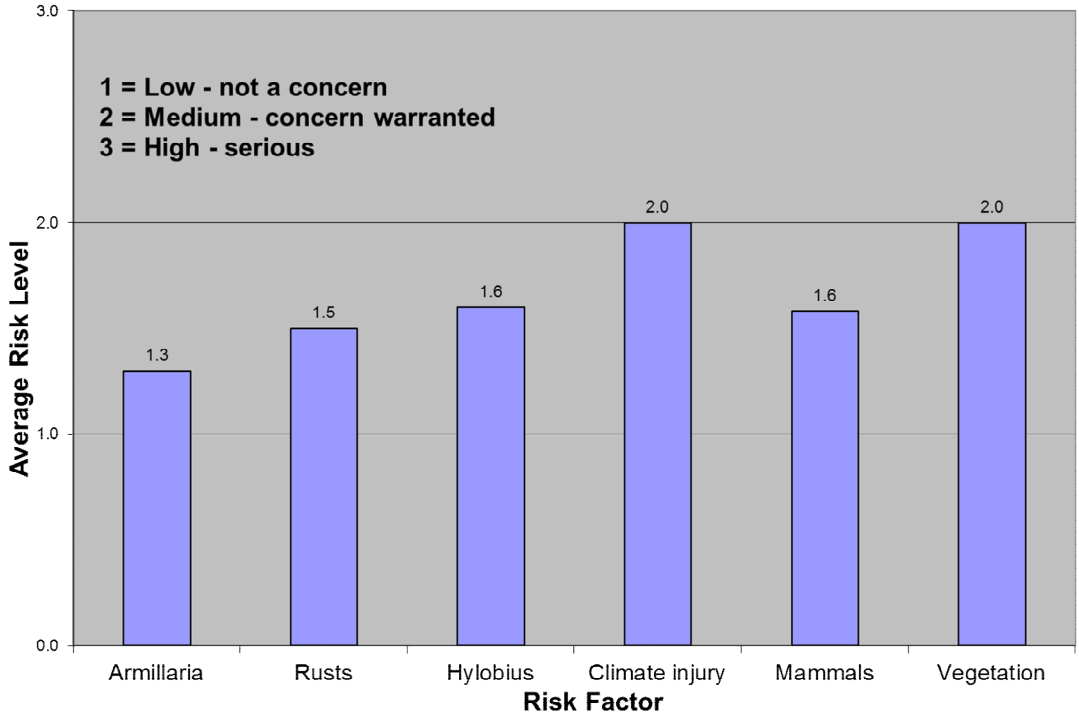
Annual updates and enhancements to the regeneration model will continue to be released by March 31 in 2013, 2014 and 2015. By the end of this period, data will have been obtained and analysed from all RLP installations to stand age 14, and a plan developed for on-going monitoring and projection.

Appendix

Decision Support Tools for Management of Regenerated Lodgepole Pine

Threat and Priority Assessments by Workshop Participants

Pre-workshop Assessment of Threats to Regeneration Success



Priority Assessment by Workshop Participants

Project	Interest / Required Action	Score[2]
MPB Decision Support Tool	Enhanced regeneration prediction	11
	Enhanced timber value prediction	7
Lodgepole Pine Regeneration Model	Model format (single model, survey compatible)	11
	Treatment combinations (e.g. planting / site prep)	6
	Yield linkage (e.g. MAI)	5
Risk Management Discussion Group	Post-MPB management	12
	Climate effects	10
	Group initiation	9
	Species selection	7

[2] Sum of individual scores calculated from priorities assigned by each respondent: 3 = first priority, 2 = second priority, 3 = third or lower priority. Only cumulative scores of 5 or more are shown.

Average Treatment Preferences of FGYA Member Companies

Operation / Treatment	EcoClass					All Classes
	1	2	3	4	5	
A. Harvest						
Cut-to-length - all processing at stump	0.2	0.3	0.3	0.3	0.4	0.3
Full tree - all processing at roadside	2.8	2.3	2.3	2.3	2.2	2.3
Other	0.5	0.5	0.5	0.0	0.0	0.3
Tree-length - topping & delimbing in cutover	0.2	0.5	0.5	0.5	0.6	0.5
B. Site preparation						
Manual - hand scalping	0.4	0.3	0.7	0.5	0.4	0.5
Mechanical scarification	2.0	2.0	1.8	2.2	2.2	1.9
None (other than harvest operation)	1.0	0.7	0.8	0.8	0.4	0.8
C. Regeneration system						
Direct seeding	0.2	0.5	0.3	0.3	0.4	0.4
Natural	1.8	2.0	1.0	0.0	0.6	1.1
Planting	1.2	1.4	2.1	2.7	2.0	2.0
D. Species selection						
Lodgepole pine	2.6	2.4	1.9	1.6	1.8	2.0
Other	0.0	1.0	0.0	0.0	1.7	0.6
White spruce	0.2	0.7	1.4	1.9	0.7	1.0
E. Planting						
Delayed (3 or more years after harvest)	0.4	0.3	0.2	0.0	0.2	0.2
Fill-in only	0.8	1.0	0.5	0.2	0.8	0.7
Genetically improved stock	0.3	0.4	1.2	1.4	0.0	0.8
Within 2 years of harvest	2.2	2.4	2.9	3.0	2.7	2.7
F. Tending						
Chemical	0.6	1.0	1.7	2.3	1.2	1.4
Combined chemical /mechanical	0.2	0.2	0.5	0.5	0.2	0.3
Mechanical	0.2	0.3	0.7	0.8	0.6	0.5
G. Miscellaneous						
Fertilization	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0
Pre-commercial thinning	0.2	0.3	0.5	0.2	0.0	0.3

Preference Scale:
0 = Never
1 = Sometimes
2 = Usually
3 = Always
(The most preferred treatment for each ecoloical site class is highlighted in red)