Integrating Riparian Research into Adaptive Forest Management

By Richard McCleary, March 31, 2006

1. Introduction

The Riparian Management Review Committee of Alberta Sustainable Resource Development (SRD) recommended that research projects and adaptive management initiatives address seven key riparian management functions and 11 goals that are related to the conservation of these ecological functions (Borutski et al., 2005). In 2002, the Foothills Model Forest began researching on a subset of the seven functions that relate to fish habitat and water quality. The research will continue through 2007. The knowledge gained from this research is intended to support an adaptive approach for managing riparian areas as an alternative to the watercourse classification approach from the Alberta Timber Harvest Planning and Operating Ground Rules. This shift from a rules-based approach to a science-based approach for forest management is consistent with existing forest management policy, however, a method to translate the change in policy to a change in timber harvest practices has not been established. In this document, I introduce a framework that could be used to guide timber harvest planning near streams within an adaptive management framework. Rather than a rules-based approach, I propose a risk-based system for establishing harvest boundaries near streams.

To ensure that I achieve the end goal of this research endeavor - to advance sustainable forest management - I require an exchange of information between researchers, industry foresters, regulators and policy makers throughout all stages of the project. I also need to start with a vision of what the final adaptive management system could look like. Therefore, in this document I present the concept of a risk-based approach and I compare it to the current rules-based system. The project is in intermediate stages and your feedback on these ideas will help in the evolution of the project.
2. Comparison of Rules-Based vs. Adaptive Approaches for Managing Riparian Areas

The rules-based style and the two adaptive styles of riparian management have different goals, components and levels of integration with riparian management and upland forest management (Table 1).

Table 1. Comparison of goals, adaptive management strategies and riparian/upland integration for three styles of riparian management.

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<th>Rules-based</th>
<th>Adaptive Management</th>
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<td><strong>B. Style:</strong></td>
<td>1. Ground Rules</td>
<td>2. Variable Width</td>
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<td>C. Management Goals</td>
<td>• Protect riparian values along permanent streams using rules-based approach.</td>
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<td>D. Adaptive management components</td>
<td>• Compliance monitoring</td>
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<td>E. Integration of riparian and upland management</td>
<td>• Complete separation of riparian versus upland management.</td>
<td>• Partial separation of riparian and upland management. • Opportunities for allocation of residuals across landscape.</td>
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3. Overview of Rules-based Riparian Management

The Ground Rules are designed for a traditional two-pass harvest system where standard width riparian buffers accomplish a number of goals including conservation of wildlife habitat, fish habitat and water quality (Figure 1). Fixed width buffers offer a low risk approach for accomplishing the range of riparian management objectives in Alberta (Lee and Smyth, 2003). However, there are no requirements to measure whether these goals are ever accomplished by this passive riparian management approach. If this system is used over the long-term, eventually most old forest will occur in riparian areas with little in the uplands (Andison and McCleary, 2002).

Figure 1. Example of ground rules riparian buffers from traditional two-pass harvest system.
4. Overview of Adaptive Riparian Management

4.1 A Risk-Based Method for Identifying Harvest Boundaries near Streams

Establishing harvest boundaries based on a variable width or emulation of natural disturbance approaches are not standard procedures in Alberta. A forest company wishing to use either approach must prepare an application with a requested variance from the ground-rules for each proposed cut-block. The application must include a description and justification that will be considered by the local forest officer. Variances that use a terrain boundary, such as the break in slope, have been submitted and approved within various SRD Areas (Borutski et al., 2005).

The criteria that SRD forest officers use to evaluate a request for variance were not explicitly stated prior to 2005. Recently Borutski et al. (2005) recommended that riparian management strategies maintain key ecological functions, however no procedures to evaluate a request for variance based on these criteria have been established. In other jurisdictions of North America researchers have produced maps displaying sensitivities of riparian areas to changes from logging and these maps have proved useful for establishing of harvest boundaries and techniques that conserve key ecological functions (Benda et al., in press). Through the riparian research program at the Foothills Model Forest we are studying key ecological processes that influence water quality and habitat structure and the products from this research could include maps that show the risk of erosion and importance of woody debris within individual channel segments (Figure 2 and Figure 3). Using the principle of maintaining ecological functions by avoiding sensitive areas, these maps could guide the establishment of variable width buffers.
Figure 2. Example of streambank erosion rating map that could be use to establish and evaluate riparian harvest plans.

Figure 3. Example of woody debris function rating map that could be used to establish and evaluate riparian harvest plans.
The emulation of natural disturbance approach uses an iterative procedure to select patches of forest that will not be harvested. For the first iteration, the forest planner would use a simulation model or other objective approach to create a pattern of residual patches (Figure 4).

![Residuals from natural disturbance emulation (20% retention)](image)

Figure 4. Example of randomly generated patches representing 20 percent retention within a 2,500 ha landscape area.

During following iterations, the forest planner could adjust the pattern to meet a range of management objectives including timber harvest operations, fish habitat and water quality conservation. The risk-based maps along with information on the natural range of variation for the target ecological functions (Figure 5 and Figure 6) could be used during the refinement of the residual pattern.
Figure 5. A hypothetical example of the natural range of variation of wood storage - an important ecological component in riparian areas. This information could be used to provide context if a management activity is forecast to change to an ecological function.

Figure 6. A hypothetical example of the natural range of variation of sediment yield. Sediment yield is an indicator of water quality and can be influenced by harvest in riparian areas.

The information used by the forest planner would be made available to the SRD forest officer during their evaluation of the harvest plan.
4.2 Options for Compliance and Effectiveness Monitoring

Adaptive management is dependent on two feedback mechanisms. The first mechanism, compliance monitoring, answers the question “Did they do what they said they were going to do?” The second procedure, effectiveness monitoring, answers the question “Did the activity create the desired results?” This research will produce a number of tools for use during both of these activities.

A regulator could use the risk-based maps to identify sensitive areas where compliance checks could be conducted. Within the sensitive areas, the regulator could check if the approved plan was followed based on indicators including proximity of stumps to the stream, percent of basal area removed within the riparian zone and degree of soil disturbance or rutting.

Within an adaptive management approach, the forest company would be responsible for effectiveness monitoring using science-based procedures. To evaluate affects on water quality and fish habitat, we will adapt tools that have proved useful in other jurisdictions for use within the Foothills streams and riparian areas. The direct measurement of key ecological functions has proven unfeasible in other areas, however measures of channel characteristics and large woody debris have worked well in similar monitoring programs (MacDonald et al., 1990).

5. Conclusion

Adaptive riparian management could use a risk-based approach to help planners and regulators decide if anticipated changes to key ecological functions are acceptable. Adaptive management also entails monitoring both for compliance and effectiveness. The ongoing research is intended to develop both knowledge of key ecological functions and tools to support the management process. An adaptive approach for managing riparian areas may also prove useful for a range of situations including developing strategies to reduce the risk of the Foothills lodgepole pine forests to mountain pine beetle infestations.
6. Literature Cited


Benda, L. et al., in press. Integrating terrain databases, GIS, and river ecology for efficient watershed analysis and resource management.

