Introduction
Management of riparian zones has become one of the foremost issues of forest management in Canada. At the Foothills Model Forest in Hinton, Alberta, we have been looking at fire patterns in riparian zones as part of our natural disturbance program. Understanding why and how fire burns through these riparian corridors will ultimately help us better manage them. However, whether or not we can or should emulate nature in this case, and at this time, is another question that we shall also endeavour to address in this paper.

The land partners involved in the FMF Natural Disturbance Program include Weldwood of Canada Ltd., Jasper National Park, Alberta Newsprint Company, and the Alberta Land and Forest Service. The growing list of project contributors includes Weyerhaeuser of Canada Ltd., Blue Ridge Lumber Ltd., Millar Western Forest Products Ltd., the Cultural Ecology and Restoration project at the University of Alberta, and the Western Fire Center.

Background
One of the founding principles of the FMF Natural Disturbance Program is that we endeavour to ask clear scientific questions that stem from a practical issue from our partners. The practical issue in this case is the desire to manage riparian zones more in keeping with nature. The measurable, scientific questions that arise from this issue are twofold:

1) Do fires differentially affect riparian zones?
2) Do riparian zones pose unique emulation challenges?

1) Do fires differentially affect riparian zones?
It is easy to think that fires burn differently through riparian zones relative to adjacent upland sites. Species composition, tree size, and even tree density tend to change through riparian zones. We installed 54 transects across riparian zones on the FMF and took detailed measurements of size, species, and age to test the theory that age also tends to change. Essentially, we wanted to know if there was a greater chance of trees surviving fires as veterans in riparian corridors.

There are two ways that fires may affect riparian areas. First, fires burn through them, but do so at lower intensities, and thus leave a higher than expected number of veterans. Second, fires may physically stop within the riparian zone. We tested both hypotheses.

Our results showed that of the 54 transects, sixteen percent had higher than expected numbers of veterans. Where we did find more veterans than expected, they tended to be in riparian areas where spruce dominated, across major
streams or rivers, and within very steep topographic profiles. Only ten percent of our transects showed evidence of having stopped fires. Overall, there is not a lot of support for either hypothesis; riparian zones do not have a tremendous impact on fire behaviour. On the other hand, 27% of all samples showed a higher than expected number of very young trees that seeded in well after the last fire, as “ingress”. In summary, fire is in fact, a mechanism by which some riparian zones are maintained structurally, but in ways we did not immediately foresee.

The results were consistent with our findings from other projects. We have already determined that fires on the FMF burn over vast areas, and that old forest occurs in medium-sized patches. Logic dictates that if riparian zones significantly affected fire behaviour, the landscape would be patchy, and old forest would tend to be more linear.

So far, results suggest that protecting riparian zones is a very “unnatural” management strategy. Not only do fires not allow a large proportion of riparian trees to survive, but they also control ingress. The potential ecological implications of riparian protection during harvest are numerous, including;

a) Shrinking or eliminating grassland or shrub riparian habitats,

b) Changing the dynamics of coarse-woody biomass accumulation in streams.

c) Increasing the risk of fire, insect and disease outbreak everywhere by leaving a network of older forest to decline.

d) Decreasing landscape productivity by ignoring and allowing to decline that portion of the landscape covered by riparian zones.

e) Decreasing the proportion of interior old forest by forcing them into linear spatial elements.

None of the above are trivial consequences, and for the most part we have come to recognize the folly of trying to permanently preserve any part of the boreal forest landscape. For instance, the Weldwood long-term plan projected the proportion of old spruce forest to increase dramatically over the next 100 years due to riparian zone protection rules. However, we have yet to resolve the problems related to other emulation issues.

2) Do riparian zones pose unique emulation issues?

Many research projects have demonstrated that riparian zones are particularly sensitive to soil issues such as erosion and compaction, leading to increased sedimentation and changes in aquatic nutrient status. This is not to say that these are not natural phenomenon, but there is no denying that fire – a chemical process - has no equivalent “footprint”. The questions that we cannot answer are 1) what is the natural range of these phenomena, and 2) what function(s) do they serve?

Clearly, there is no ecological equivalent to harvesting in riparian zones from a soils perspective. The NRV model in this case suggests that no mechanical activity and tree removal is preferable.
Where does that leave us?
On medium to large scales, disturbing riparian areas is a healthy component of any boreal landscape, maintaining historical age and patch-size distributions, minimizing natural hazard risk, and allowing older forest to exist in large, uninterrupted patches. Unfortunately, at very fine scales, quite the opposite is true. Traditional harvesting in riparian zones compacts soil, may create soil rutting, removes potentially important biomass, and potentially increases sedimentation and nutrient levels beyond those experienced historically.

So should we harvest in riparian zones? Given the conclusions drawn above, a better question to ask might be “how should we disturb riparian zones”? We have a far greater chance of finding alternative methods of riparian area management than we do mediating the impacts of leaving riparian strips on landscapes. We have already spent an enormous effort developing manoeuvrable light-touch machinery. Our expertise using fire as a tool is growing every day. We have been studying the impacts of harvesting on riparian zones under different scenarios. We are undeniably already moving towards finding solutions for managing riparian zones that involve more and more disturbance of some sort.

That is not to say that we know everything there is to know. For instance, what is the NRV of disturbance-driven sedimentation in aquatic systems? How much do we really understand about the roles and risks of sediment, nutrient additions, or woody debris in streams? Is it possible to use prescribed burning for linear landscape elements? Are there alternative, economically-viable methods of harvesting and/or removing trees from riparian zones?

It is safe to say that we are not where we want to be just yet with riparian management. However, we do know the direction in which we want to move. In the meantime, we have to be prepared for more new ideas. Things will surely change before we are done.