Reducing Vulnerabilities and Promoting Resilience of British Columbia's Natural and Human Systems Through Adaptation of Post-Disturbance Land Management Options

Guest Editorial

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The most demonstrable effects of climate change may be shifting natural disturbance regimes. In a recent report from the Intergovernmental Panel on Climate Change (IPCC), Working Group II (which highlights the climate change related Impacts, Adaptations, and Vulnerabilities), concludes, with very high confidence, that in the coming decades the frequency and severity of wildfire, insect outbreaks, drought, and extreme weather events will increase in North America as a result of climate change (IPCC 2011). A regional assessment of Canada's vulnerability to climate change reached the same conclusions, but noted that the highest certainty of shifting disturbance regimes will very likely be in British Columbia (BC), (Walker & Sydneysmith 2008).

Thus, a major challenge facing natural resource managers and policymakers in BC will be in adapting post-disturbance land management decisions and activities to the climate change-related shifts in natural disturbance regimes (Spittlehouse & Stewart 2003). These shifts in natural disturbance regimes and our post-disturbance management responses will have both ecological impacts (Redding et al 2012; Gayton & Lara Almuedo 2012; Swift 2012a, 2012b) and direct consequences to communities and human systems (Krishnaswamy et al 2012). Of notable concern are rural, forest-based, and Aboriginal communities, due to their individually unique and place-based ties to the environment, as well as the forest industry. These communities will likely experience a host of economic, social, and cultural impacts. Addressing this challenge should ensure that any negative impacts experienced would be less severe than had no adaptation occurred, and it is imperative that any adaptation actions taken by governments, industry, communities, and individuals are based on our best and evolving understanding of risk and vulnerability.

To help natural resource managers, policymakers, and others address this challenge, Forum for Research and Extension in Natural Resources (FORREX) and its partners have devised and implemented a project funded by the BC Future Forest Ecosystem Scientific Council (FFESC) to develop a Decision Support Framework. This framework can be applied at a variety of scales (e.g., at a Provincial Level, regional level, district level, and stand level) to assist in the development of post-disturbance land management and adaptation strategies that promote and (or) maintain forested ecosystems that are resilient to the potential and uncertain shifts in natural disturbance regimes associated with climate change.

The discussion papers and extension notes in this issue of the BC Journal of Ecosystems and Management are one extension product from this project. The "Decision Support Framework" (Swift 2012c) is the key discussion article in this journal issue. The

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framework is presented as a mental model designed to provide strategic guidance on how information related to projected changes in natural disturbance regimes can be integrated into actions and decisions on the ground. It consists of three main adaptation framework actions or pillars that are used to inform those decisions: 1) providing evidence/effects, 2) increasing adaptive capacity, and 3) addressing competing pressures. Because of the regional nature of expected shifts in natural disturbances (Haughian et al 2012), a more strategic approach is presented. It is hoped that by following this approach, actions can be customized to specific locations based on specific information.

In support of the framework, a number of topical syntheses were compiled to define and quantify the potential effects of major disturbance types and the incremental effects of management decisions on natural (e.g., watershed values, forest succession, forest carbon, and biodiversity) and human (e.g., social, economic, and cultural communities, including First Nations) systems. These syntheses provide the baseline knowledge that is key information to the first pillar (evidence/effects) in the "Decision Support Framework." The full syntheses are published as *FORREX Series Report 28* (Wiensczyk et al. 2012). This issue of BC JEM also includes a series of extension notes based on those syntheses that provide a brief summary of the key impacts of natural disturbances and the incremental effects of management on these topic areas.

This issue also includes an additional research report entitled "Expected Effects of Climate Change on Forest Disturbance Regimes in British Columbia" (Haughian et al. 2012) that synthesizes the literature on the expected shifts in the frequency and severity of major natural disturbance events associated with a changing climate in BC. The goal of this research report is to point out important differences among the regions of BC in terms of their susceptibility to disturbance regime shifts; these expected trends and differences will, in turn, help to focus the application of the Decision Support Framework and assist decision makers in the selection of suitable management options. It is anticipated that forest fires will be more frequent and more intense in some locations of the province (the Southern Interior and Taiga Plains), forest insects and fungal pathogens will expand their ranges northward and to higher elevations along with their hosts, and wind damage, floods, and landslides will increase on terrain where they are already a risk factor. The research report concludes that although a greater compilation of empirical and simulated data is required, land managers may wish to adjust plans accordingly where consensus exists among climate projections.

The successional pathway along which a forest develops in terms of structure and function is strongly influenced by natural and human-induced disturbances or combinations of disturbances such as wildfire, insect and disease outbreak, windthrow and forest harvesting. "Successional Responses to Natural Disturbance, Forest Management and Climate Change in British Columbia's Forests" (Swift 2012a) briefly describes the successional pathways of a variety of ecosystems found in BC, as well as how forest management practices have affected those pathways. This extension note also describes how projected changes in temperature and precipitation may affect the natural disturbance drivers of succession.

"Natural Disturbance and Post-Disturbance Management Effects on Selected Watershed Values" (Redding et al. 2012) summarizes how climate change, wildfire and insect infestations, and salvage harvesting may impact the magnitude and timing of streamflow, stream temperature, suspended sediment, and aquatic invertebrate population dynamics. Maintenance of natural hydrologic and ecosystem function following post-disturbance management activities is critical to maintain the resilience of watersheds (i.e., the ability of natural systems to recover from perturbation). Key considerations include planning management

activities at the site, watershed and landscape scales using the best available information along with qualified watershed professionals, maximizing riparian overstory retention, minimizing the introduction of fine sediments into surface water bodies, and monitoring the effects of disturbances and management interventions to support adaptive management.

"Post-Disturbance Management of Biodiversity in BC forests" (Gayton & Lara Almuedo 2012) provides information on the impacts of natural disturbances and the post-disturbance management response on biodiversity and ecosystem resilience using three indicator species groups: ground-dwelling arthropods, small mammals, and birds. The extension note concludes that the most effective way to promote biodiversity and ecosystem resilience is to maintain or reinstate those natural disturbance patterns where possible, and to emulate them in our forest harvesting activities. Where and when feasible it is also recommended that some areas should be left unaltered to allow for the ecological role of natural disturbance and ecosystem recovery to run its course.

Maintaining forest ecosystems as a carbon sink is one of the current strategies suggested to help mitigate the impacts of climate change in the extension note "Forest Carbon and Management Options in an Uncertain Climate" (Swift 2012b). Managing for carbon will require that forest managers have access to information on strategies, tools, and activities to help them achieve this objective. This extension note synthesizes this information, and also explains that the capacity of an ecosystem to sequester and store carbon is a function of many key variables, including the aspect and elevation of the site, nutritional status, stand characteristics, and disturbance history. It also stresses the importance of being cognizant of the need to continue balancing forest values, because a long-term focus on maximizing carbon sequestration can result in detrimental impacts on other forest values such as biodiversity and the use of forests for building products.

Communities must also make land management decisions related to increasing the adaptive capacity of the community to respond to changes in natural disturbance frequency and severity as a result of climate change. Some of these options are discussed in "Increasing the Resilience of British Columbia's Rural Communities to Climate Change Induced Natural Disturbances" (Krishnaswamy et al. 2012). Rural, forest-based, and First Nations communities are especially vulnerable because their economic, social and cultural aspects of life are closely linked to the local environment and climate. The extension note on human dimensions focuses on addressing the impacts of wildfire on communities. It describes the uncertainty of predicting the frequency and intensity of natural disturbances in a particular location and suggests that the most effective management response to address this uncertainty is to focus on reducing vulnerability and increasing community resilience. The extension note also provides a condensed list of the management strategies and tools that communities have been using in BC and elsewhere to increase community resilience to natural disturbances and climate change.

The post-disturbance land management decisions that are made today will have far-reaching implications on both natural and human systems, both now and into the future. The issues facing decision makers will be complex and their decisions will require assessing and balancing the impacts of management activities on a whole suite of forest values. It is hoped that the "Decision Support Framework" and the supporting extension notes included in this issue will help determine when, where, and what type of management interventions could be applied to support healthy ecosystems and communities under threat of increased natural disturbance due to climate change. The framework has been developed within the context of adaptive management, with the aim to reduce uncertainty over time and improve future management.

References

Gayton, D. & P. Lara Almuedo. 2012. Post-disturbance management of biodiversity in BC forests. BC Journal of Ecosystems and Management 13(1). URL: http://jem.forrex.org/index.php/jem/article/viewFile/184/114

Haughian, S.R., P.J. Burton, S.W. Taylor, & C.L. Curry. 2012. Expected effects of climate change on forest disturbance regimes in British Columbia. BC Journal of Ecosystems and Management 13(1). URL: http://jem.forrex.org/index.php/jem/article/viewFile/152/107

Intergovernmental Panel on Climate Change (IPCC). 2011. Summary for Policymakers. In: Field, C. B., Barros, V., Stocker, T.F., Qin, D., Dokken, D., Ebi, K.L., Mastrandrea, M. D., Mach, K. J., Plattner, G.-K., Allen, S., Tignor, M., & P. M. Midgley (editors). Intergovernmental Panel on Climate Change Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. URL: http://ipcc-wg2.gov/SREX/images/uploads/SREX-SPM_FINAL.pdf (Accessed March 2012).

Krishnaswamy, A., E. Simmons, & L. Joseph. 2012. Increasing the resilience of British Columbia's rural communities to natural disturbances and climate change. BC Journal of Ecosystems and Management 13(1). URL: http://jem.forrex.org/index.php/jem/article/viewFile/168/115

Redding, T., S. Lapp, & J. Leach. 2012. Natural disturbance and post-disturbance management effects on selected watershed values. BC Journal of Ecosystems and Management 13(1): http://jem.forrex.org/index.php/jem/article/viewFile/172/106

Spittlehouse, D.L., & R.B. Stewart. 2003. Adaptation to climate change in forest management. BC Journal of Ecosystems and Management 4(1):7–17. http://www.forrex.org/publications/jem/ISS21/vol4_no1_art1.pdf (Accessed February 2012).

Swift, K. 2012a. Successional Responses to Natural Disturbance, Forest Management, and Climate Change in British Columbia's Forests. BC Journal of Ecosystems and Management 13(1). URL: http://jem.forrex.org/index.php/jem/article/viewFile/171/113

Swift, K. 2012b. Forest carbon and management options in an uncertain climate. BC Journal of Ecosystems and Management 13(1). URL: http://jem.forrex.org/index.php/jem/article/viewFile/169/110

Swift, K. 2012c. Decision Support Framework: Integrating the environmental and human dimensions into decision making related to changes in natural disturbance events. BC Journal of Ecosystems and Management 13(1). URL: http://jem.forrex.org/index.php/jem/article/viewFile/185/121

Walker, I.J., & R. Sydneysmith. 2008. British Columbia. In: Lemmon, D.S., F.J. Warren, J. Lacroix, and E. Bush (eds.). From impacts to adaptation: Canada in a changing climate 2007. Government of Canada, Ottawa, ON. pp. 329–386.

Wiensczyk, A.M., T. Redding, J. Leach, K.I. Swift, S. Ran, P. Lara Almuedo, D. Gayton, A. Krishnaswamy, E. Simmons, L. Joseph, & D. Cuzner. 2012. Climate-induced changes to natural disturbance regimes and management responses in British Columbia: Impacts on natural and human systems. Forum for Research and Extension in Natural Resources (FORREX), Kamloops, BC: FORREX Series 28.

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