Reducing vulnerabilities and promoting resilience of BC's natural and human systems through adaptation of post-disturbance land management options

Final Report
November 30, 2009 – March 31, 2012

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The overall goal of this extension project was to design a decision support framework[1] for post-disturbance land management to inform adaptation strategies to address shifts in natural disturbance regimes resulting from climate change. The objectives of the project were to

1) synthesize the current state of knowledge and projections around shifts in the frequency and severity of major disturbance types (e.g., fire, pests, drought) in BC, which are attributable to climate change,
2) define and quantify the range of potential effects of major disturbance types, as well as post-disturbance land management responses on natural (e.g., watershed function, forest succession, carbon storage, conservation biology), and human systems (e.g., social, economic, cultural, and communities, including First Nations), and
3) develop a regionalized Decision Support Framework to help guide decision makers to ultimately reduce the climate change impacts of shifting natural disturbance on forest and range productivity and human systems.

Deliverables for this extension project include a discussion paper and a series of extension notes, which are being published in the BC Journal of Ecosystems and Management 13(1), full topical syntheses, which are being published as a FORREX series, formation of a Community of Practice, and workshops and webinars. This report summarizes the results of this extension project. For more specific and detailed project results please refer to the journal articles and FORREX series publication, including Wiensczyk (2012) which introduces the project and provides a brief synopsis of project results for journal readers.

Research process:

Decision Support Framework

The objective of the Decision Support Framework is to provide guidance on how to integrate information related to the projected changes in natural disturbances into on the ground post-disturbance management actions and decisions. The process for the development of the Framework involved three approaches. The first involved the development and delivery of a survey "Decision making processes with respect to changes in natural disturbance regimes as a

[1] Decision Support Framework: For this project a decision support framework is defined as a mental model designed to provide strategic guidance for decision makers who are developing management strategies and actions related to addressing projected shifts in natural disturbance regimes.

result of climate change" to individuals considered "early adopters". Early adopters are people who have a history of putting science based information into practice early in the life of that information. The early adopters chosen for this survey were from government organizations, nationally owned private forest companies, not-for-profits, universities, communities, first nations groups and community forest corporations. The purpose of the survey was to develop some preliminary baseline information on which to base further discussions and extension activities in this subject area. The second approach was to invite these early adopters to participate in one of four one-day regional dialogue sessions (Nanaimo, Prince George, Smithers and Kamloops) where part of the agenda included discussions on various aspects of current decision making in this area. The third approach involved the collection and review of information and literature related to any existing decision support and climate adaptation frameworks being used elsewhere (nationally and internationally) to support changes in natural disturbance events. The objective of conducting this review was to determine what approaches other jurisdictions are using, and to determine what elements may be useful for British Columbia to provide support for both the ecological and the human systems operating in the province.

Topical Syntheses

The objective of the topical syntheses is to support the decision framework by providing

1) information on the potential effects of major disturbance types, as well as post-disturbance land management responses on forest successional patterns, forest carbon, watershed function, biodiversity, and human systems, including First Nations, and
2) information on decision support tools that can help clarify decisions and needs (e.g., models, checklists, factsheets, processes such as multi-criteria analysis, scenario planning, risk analysis, vulnerability and hazard assessments, etc.)

For the preparation of the topical syntheses (forest successional patterns, forest carbon, watershed function, conservation biology and ecology, and human systems, including First Nations) the project teams assembled advisory/working groups to provide advice on strategies to address the subject matter, to assist with the development of their synthesis outline, and to identify potential information sources. The Human Dimensions team also utilized the services of an international expert with experience in dealing with the human dimensions of climate change to help refine the focus of their synthesis.

For each of the topical areas the project teams conducted extensive reviews of the latest available published and grey literature, gathered information from current research projects, reviewed existing extension products (e.g., Compendium of Forest Hydrology and Geomorphology, Watershed Management Information Needs Assessments, etc.), attended events (e.g., workshops, conferences, round table discussions, etc.) and held discussions with the experts to develop the content of their syntheses.

Disturbance Regime Analysis

The disturbance regime analysis work consists of two phases both of which are designed to support the decision support framework by providing land managers with information on which

regions in British Columbia are most susceptible to shifting disturbance regimes. The first phase of the disturbance regime analysis work summarizes the current state of knowledge and prediction science (published and unpublished) on the shifts in the frequency and severity of major natural disturbance types in British Columbia. The second phase involves a novel analysis of historical trends detectable in the B.C. Natural Disturbance Database (Canadian Forest Service) that are then projected into the anticipated future climate regime using climate envelopes and ClimateWNA software.

Community of Practice

The objective of the Ecological and Community Resilience Community of Practice (CoP) is to support the Decision Support Framework by engaging with experts in the areas of forest management, biodiversity and wildlife, community resilience, natural disturbance processes, climate adaptation, decision support frameworks and risk assessment so that they can share their information, knowledge and experience with others in the group and help improve the decisions of land and community managers with respect to the management of natural disturbances. Project team members and FORREX partners are helped to identify potential Community of Practice members.

Collaboration:

Decision Support Framework

A variety of specialists were contacted to provide advice on the decision support framework component of this project. Discussions were held with members of the Saskatchewan climate change research team responsible for developing the climate change adaptation framework for the Canadian Council of Forest Ministers Climate Change taskforce. Preliminary discussions were also held with regional decision makers working in the central interior of BC to identify areas where the decision support framework could be useful. In addition, as described in the research process section, an online survey and a series of 4 working sessions with early adopters were used to gather their input in the development of the framework. Discussions were also held with FFESC project proponent Don Morgan.

Topical Syntheses

A variety of specialists and experts were contacted by the project teams to provide advice on the topical syntheses. The Forest Succession and Forest Carbon synthesis team consulted with Hamish Kimmins, Bruce Larson, and Brad Seely (UBC), Werner Kurz (CFS), Mark Johnston (Saskatchewan Research Council), Caren Dymond (MFLNRO), and Ian Moss (consultant) to name a few. The team also consulted with other FFESC proponents including Anne Chan-McLeod (UBC), Louise De Montigny and Walt Klenner (MFLNRO), and Ken Zielke and Bryce Bancroft (consultants). The Human Dimensions synthesis collaborators include Bonnie McFarlane (NRCan), Jenny Fraser (MOE), Annie Booth (UNBC), Bill White (CFS), Dawn Morrison and Tara Willard (BC Food Systems Network on Indigenous Food Sovereignty), Howie Harshaw (UBC), Jim Munro (Maiyoo Keyoh Society), Lisa Levesque (MFLNRO), Nastenka Calle Delgado (Pacific Solutions for Climate Research), and Stephen Tyler (consultant). The Watershed values team collaborated with Kevin Bladon (TRU) and John Rex (MFLNRO) and informally canvassed

colleagues and practitioners in the watershed management community to discuss concepts and ideas during the preparation of their synthesis. The Biodiversity team networked with other members of the team and collaborated with Sandy Smith (U of T), Tom Sullivan (UBC and Applied Mammal Research Institute), Kathy Martin (UBC), John Spence (U of A), and Marten Geertsema (MFLNRO), who provided guidance and relevant information resources and reference material for their synthesis.

Disturbance Regime Analysis
While the disturbance regime analysis component has primarily served to provide plausible scenarios to other components of this project, it has also served an informal role of bridging with other FFESC research teams. Phil Burton is also a team member of the DeLong, Summerville, and Morgan research teams, and has participated in meetings with those groups. This has led to some cross-fertilization of ideas, the identification of efficiencies to reduce workload duplication, and eventual joint meetings by larger groups.

Community of Practice
The Community of Practice (CoP) team drew on the experience of the project team and also contacted Chris Ritchie (MOE), Art Kaehn (Fraser-Fort George Regional District), Dan Adamson (City of Prince George) and Doug Routledge (COFI) to gather input on potential CoP members. They also met with other FFESC project proponents Egger (Summerville project), Coxson, and DeLong to discuss synergies among the socio-economic components of the respective projects as well as between the Community of Practices being formed with this project and the Summerville project.

***Communication*:**

To communicate general project progress and outcomes with others we developed a website (http://ffesc.forrex.org/) and produced a summer 2010 newsletter (http://ffesc.forrex.org/sites/ffesc.forrex.org/files/docs/summer2010_newsletter.pdf). The synthesis, disturbance regime analysis, community of practice and decision support framework teams have also communicated with other researchers, government staff and NGO's via email and phone calls. The Decision Support Framework was also presented and discussed at a meeting with Wildfire Management Branch (WMB) staff and has been used by Branch staff to help guide the development of their WMB strategic plan.

Research outcomes:

Decision Support Framework
The overall goal of this project was to develop a Decision Support Framework to help guide decision makers to ultimately reduce the impacts of shifting natural disturbance regimes due to climate change on forest and range productivity and human systems. This objective (#3) was achieved through the publication of the following discussion paper.

Swift, K.I. 2012. 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): http://jem.forrex.org/index.php/jem/article/viewFile/185/121

The framework is presented as a mental model that can be applied at a variety of scales (e.g. at a Provincial level, regional level, district level, and stand level) to assist in making decisions related to the development of post-disturbance land management and adaptation strategies and policies that promote and (or) maintain forested ecosystems that are resilient to the potential and uncertain shifts in natural disturbance regimes associated with climate change.

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. Under the first pillar, decision makers gather and assess evidence regarding the need for, and the extent of, any potential change in management actions or policies as well as on the potential impacts these changes may have on other forest or community values. The second pillar involves using evidence-based tools to explore the implications of any management or policy changes selected under pillar 1. There are many decision support tools available and it is important that decision makers be able to recognize which tool(s) can help with which decision as well as the probabilities, risks, and scientific uncertainties associated with each tool. Some tools may also be able to be adapted or modified to address the decision at hand. Some examples of available decision support tools include, the Tree and Climate Assessment Tool (TACA), Watershed and Vulnerability Assessments, the ISO 31000 Risk Management Framework, and cost/benefit analyses. There are many others. The final pillar involves helping the decision maker determine how to best integrate the decision into the wider context of the public policy, planning and/or regulation frameworks that they are working in. Due to the regional nature of changes in natural disturbance and the strategic nature of the decision support framework, it is hope that by following this approach, actions can be customized to specific locations based on specific information to address specific needs.

Note: For Policy Makers working for provincial governments with the responsibility of managing the public landbase under a changing environment, one of the key elements that will have to be addressed in any decision making process, including the one described above, will be addressing risk and how that risk can be shared with other organizations or agencies working on the same landbase.

Topical Syntheses

The objective (#2) of the topical syntheses were to define and quantify the range of potential effects of major disturbance types and incremental effects of management on natural (e.g., watershed values, forest succession, forest carbon, and biodiversity) and human systems (e.g., social, economic, cultural, and communities, including First Nations). These syntheses provide the base line knowledge that is key to the evidence/effects pillar in the decision framework. This objective was achieved through the publication of extension notes in the BC Journal of Ecosystems and Management and a FORREX series. The extension notes present a brief

summary of the key impacts of natural disturbances and the incremental effects of management on each of the topical areas. They are intended for the natural resource management decision maker who has limited time and is primarily interested in the key take home messages. The FORREX series publication contains the full synthesis work for each of the topical areas and is intended for those who are interested in the details.

Watershed Values

Redding, T., S. Lapp, and 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

Redding, T. and J. Leach. 2012. Chapter 3. A synthesis of the effects of natural disturbance and post-disturbance management on selected watershed values. FORREX Series 27. [in press]

These two publications synthesize available research on the effects of climate change, natural disturbance (focused on wildfire and insect infestation), and post disturbance management actions (primarily clearcut salvage harvesting) on key watershed processes and values. The scope of the synthesis was limited to: the magnitude and timing of streamflow, stream temperature, suspended sediment, and aquatic invertebrate population dynamics. In general, the effects on hydrologic processes and watershed functions are greater following post-disturbance activities; climate change is anticipated to further negatively compound these natural disturbances. To maintain the resilience of watersheds (that is, the ability of natural systems to recover from perturbation), management activities should be designed to maintain natural hydrologic and ecosystem function wherever possible. Key considerations to maintain resilience include: planning management activities at the site, watershed and landscape scales, maximizing riparian overstory retention within 10 metres of streams, minimizing the introduction of fine sediments into surface water bodies, and monitoring the effects of disturbances and management interventions to support adaptive management. Using the best available information, along with qualified watershed professionals, is key to ensuring the effective management.

Biodiversity and Ecosystem Resilience

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

Lara Almuedo, P. and D. Gayton. 2012. Chapter 4. Disturbance and post-disturbance management in forested ecosystems of British Columbia: A literature review. FORREX Series 27 [in press]

The available information on the impacts of natural disturbances and the post-disturbance management response on biodiversity and ecosystem resilience are summarized in these two

publications. Climate change will have a direct impact on ecosystems through changes in temperature and precipitation regimes; it will also have indirect impacts, by way of alterations to natural disturbance patterns. Biodiversity is recognized as a basic component of any set of ecological indicators used to balance timber and non-timber interests in planning and management. Ground-dwelling arthropods, small mammals and birds are useful indicator species of forest biodiversity trends. Patch cutting, snag retention and green tree retention are important considerations in post-disturbance harvesting. 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. Balance post-disturbance economic interests with social and ecological interests. Consider post-disturbance ecosystem recovery processes and the potential cumulative effects of coupled human and natural disturbances. Allow for the ecological role of natural disturbance where and when feasible. Manage for structural diversity, wildlife habitat diversity and landscape connectivity. Increase forest retention levels at the stand level and, more importantly, at the landscape level. Develop and implement forest management policies and practices that promote forest resiliency and increase natural adaptation capacity to climate change-induced modifications to disturbance regimes.

Forest Succession

Swift, K. 2012. Climate-induced changes to natural disturbance regimes and management responses: Impacts on successional responses. BC Journal of Ecosystems and Management 13(1): http://jem.forrex.org/index.php/jem/article/viewFile/171/113

Swift, K. and S. Ran. 2012. Chapter 1. Successional responses to natural disturbance, forest management and climate change in British Columbia's forests. FORREX Series 27. [in press]

Natural and human-induced disturbance such as wildfire, insect and disease outbreak, windthrow and forest harvesting are important drivers for forest renewal, post-disturbance stand structure and ecosystem function. Each disturbance or combination of disturbances sets up a forest to proceed down a certain successional pathway in terms of structure and function. Using the context of Ecoprovinces and Ecosystem Types, successional pathways of a variety of ecosystems found in British Columbia are briefly described as well as how forest management practices have affected those pathways. The papers also describe how projected changes in temperature and precipitation may affect these natural disturbance drivers. The information contained in these two publications is designed to facilitate further conversation in regards to building resistant and resilient forests for the future.

Forest Carbon

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

Swift, K. 2012. Chapter 2. Forest carbon and natural disturbance. FORREX Series 27. [in press]

One of the current climate change mitigation strategies is the management of forested ecosystems to ensure that they remain a carbon sink. With British Columbia's climate expected to continue to warm into the future, our forests will also change in response. If a choice is made to manage for carbon as one of the many landscape objectives, forest managers will need to know how best to do so given the suite of tools available. These two papers focus on the suite of available activities and strategies a forest manager may wish to consider if carbon is selected as a management objective. The capacity of a forest or an ecosystem to sequester and store carbon is a function of many key variables including the aspect and elevation of the site, its nutritional status, its disturbance history (harvesting, fire, insects, etc), stand characteristics (e.g., tree species, stand volume and structure, amount of deadwood, ground vegetation) and the influence of e.g., logging). It is also important to keep in mind the need to continue to balance forest values, since a long term focus on maximizing carbon sequestration can result in detrimental impacts on to other forest values, such as biodiversity and the use of forests for building products.

Human Dimensions

Krishnaswamy, A., E. Simmons, and 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): http://jem.forrex.org/index.php/jem/article/viewFile/168/115

Krishnaswamy, A., E. Simmons and L. Joseph. 2012. Increasing the resilience of British Columbia's rural communities to natural disturbances and climate change. FORREX Series 27 [in press]

It is predicted that climate change has increased the frequency and intensity of natural disturbances and weather related natural disasters. Rural forest-based communities are especially vulnerable to changes in natural disturbance regimes influenced by climate change because their economic, social and cultural aspects of life are closely linked to the local environment and climate. These publications are a synthesis of current knowledge on the impacts of natural disturbances and climate change on rural communities. In the FORREX series publication the impacts of four natural disturbances (wildfire, insects, floods, landslides) on communities are discussed while the extension note focuses on the impacts of wildfire. The human impacts of these four disturbances is indicative of the type of impacts that other natural disturbances such as drought, storms, avalanches, permafrost melt, forest diseases, erosion and gradual ecosystem change can have on communities. First Nations communities may be significantly and uniquely impacted by natural disturbances and climate change due to their remote location, strong connection and heavy reliance on the environment for subsistence and preserving their culture, and their unique and often vulnerable economic situation. The uncertainty of predicting the frequency and intensity of natural disturbances in a particular location is described. It is suggested that the most effective management response to address

this uncertainty is to focus on reducing vulnerability and increasing community resilience. Finally, a list some of the management strategies and tools that communities and those that work with them have been using in British Columbia and elsewhere to increase community resilience to natural disturbances and climate change is provided.

Wiensczyk, A., D. Gayton, and T. Redding. 2012. Introduction: Climate-induced changes to natural disturbance regimes and management responses: Impacts on natural and human systems. FORREX Series 27. [in press]

This paper provides an introduction to the topical syntheses in the FORREX series as well as general information on disturbance and management response options.

Disturbance Regime Analysis

The objective (#1) of this component of the project is to synthesize the current state of knowledge and projections around shifts in the frequency and severity of major disturbance types (e.g. fire, pests, drought) in BC which are attributable to climate change. The work has been divided into two phases. The first phase of the disturbance regime analysis work summarizes the current state of knowledge and prediction science (published and unpublished) on the shifts in the frequency and severity of major natural disturbance types in British Columbia. This part of the objective has been addressed through the publication of an extension note in the BC Journal of Ecosystems and Management 13(1).

Haughian, S., P. Burton, S. Taylor, and C. Curry. 2012. Expected effects of climate change on forest disturbance regimes in British Columbia. BC Journal of Ecosystems and Management 13(1):1-24. http://jem.forrex.org/index.php/jem/article/view/152/107

In this paper the changes to forest disturbance regimes and forest damage that are projected to emerge under a changing climate in British Columbia are summarized. Regardless of the models or emission scenarios used, it is universally expected that B.C. will experience warmer air temperatures. Projections for precipitation are more variable, ranging from slight decreases in some regions to substantial increases in others, which have different effects on disturbance projections. Forest fires are expected to be more frequent and more intense in the southern half of the province and in the Taiga Plains, but less important in other portions of the province. Forest insects and fungal pathogens are expected to more fully occupy the current range of their host tree species and expand ranges northward and to higher elevations along with their hosts. More frequent and more detrimental pest outbreaks are expected in some regions when several years of favourable weather align, which is more likely under current and projected climate trends. Wind damage, floods, and landslides can be expected to increase on terrain where they are already a risk factor. For many agents of tree mortality, an expansion or shifting of the seasonal window of activity is expected, but these changes vary among regions within B.C. The prediction of future forest disturbance regimes is in its infancy, requiring a much more concerted effort in compiling both empirical and simulated data, but managers may wish to adjust plans accordingly where there is consensus among projections.

The second phase involves a novel analysis of historical trends detectable in the B.C. Natural Disturbance Database (Canadian Forest Service) that are then projected into the anticipated future climate regime using climate envelopes and ClimateWNA software. An initial analysis was completed and was delivered as an oral presentation at the 7th International Conference on Disturbance Dynamics in Boreal Forests (Saguenay, Quebec).

Burton, P., Y. Boulanger, B. Pettit, G. Thandi, and S. Taylor. 2011. Classifying and Mapping the Forest Disturbance Regimes of British Columbia. Presented the 7th International Conference on Disturbance Dynamics in Boreal Forests (May 30, 2011, Saguenay, Quebec).

However, when projecting the climate envelopes for those disturbance regimes into the future under climate change, it was found that much of British Columbia would be covered by fire and insect outbreak regimes not currently found in BC, and for which there was no data. Further quests for additional data from the U.S. Pacific Northwest revealed that the data was fragmented and had many spatial gaps, with the time span of insect data varying considerably across jurisdictions. The analysis team concluded that the mechanistic projections developed in phase 1 of the project were just as good, and perhaps more useful, than the 'disturbance regime' and simple 'climate envelope' projections originally proposed for development under phase 2. They also determined that with the ecoprovince regionalization already completed, more refined regionalizations of particular combinations of fire (season, ignition, sizes) and insect x fire combinations would not be particularly useful for the decision support framework. As a result it was decided to not do any further work on phase 2 as part of this project.

Community of Practice

The formal Community of Practice (CoP) that was planned for development under this project was not formed. Research revealed that a Climate Change Adaptation Community of Practice already existed at the national level (http://www.ccadaptation.ca). This site is facilitated and maintained by the Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR). It supports all Canadian Provinces and Territories in their efforts to incorporate climate change adaptation into their planning and policies and enables sharing of expertise between experts across the country. The website is well designed and allows members to share information on events, publications and news as well as discuss various topics of interest. The facilitator also distributes an electronic newsletter to members as new information is added. The CoP is open to anyone who wishes to join by requesting a password from the facilitator.

A second, smaller Community of Practice also exists in the Northern Climate Change Network site (http://www.resourcesnorth.org/rna/380/nccn) which is hosted and managed by Resources North Association. This site includes a listing of top ranked, international climate change experts, profiles of those involved in climate change projects in Northern British Columbia, an electronic newsletter links to other climate change-related websites.

Recommendations

Decision Support Framework

Clients that have already used the Decision Support Framework (DSF) include the Silviculture Sub-committee of the Williams Lake Timber Supply Area (WL TSA) Working Group. This group which is composed of both government and forest industry staff is using the DSF to further discussions at the TSA level around introducing alternative silvicultural strategies that will address areas in this region that are experiencing increased risks of drought and frost due to environmental shifts. The group has begun working with another FFESC proponent (Craig Delong) and the tool he has developed to identify high risk areas. The alternative silvicultural strategies may include expanded seed planning zones, using different species, densities and forest structures, etc. The working group also plans to use the DSF to help guide them in the development of their stewardship training program.

As previously described in the Communication section, Wildfire Management Branch within the BC Ministry of Forests, Lands and Natural Resource Operations has already used the DSF to help them in the development of their Branch Strategic Plan. In addition, the DSF is being used by the Future Forest Ecosystem Scientific Council to assist them in the compilation of their final program report.

The Decision Support Framework developed in this project describes a highly adaptable decision making process that can be applied to any situation requiring a decision. It is recommended that land managers and policy makers within government and industry, and community leaders including First Nations, as well as others who manage the public landbase or are impacted by its management use the DSF to assist in natural resource management decision making and/or policy development/refinement. For further information or questions regarding this DSF and/or assistance in identifying opportunities for and applying the DSF within your organization please contact FORREX (www.forrex.org).

Topical Syntheses

The topical syntheses completed under this project provide a comprehensive summary of the potential impacts of climate change induced alterations to natural disturbance regimes and the incremental effects of management on natural (e.g., watershed values, forest succession, forest carbon, and biodiversity) and human systems (e.g., social, economic, cultural, and communities, including First Nations). The human systems synthesis also includes a list some of the management strategies and tools that communities and those that work with them have been using in British Columbia and elsewhere to increase community resilience to natural disturbances and climate change. It is recommended that natural resource managers and community leaders use these synthesis as a source of base line knowledge that is key to the evidence/effects pillar, and as a source of information on available decision support tools that can be used under the adaptive capacity pillar in the decision framework.

Disturbance Regime Analysis

The Haughian et al. (2012) paper on expected changes in forest disturbances has provided a platform for completing and publishing new work on fire regime projections (by Steve Taylor, Canadian Forest Service) and new work projecting extreme winds (by Charles Curry, formerly of

Environment Canada, now at the University of Victoria). Taylor and his colleagues in the Canadian Forest Service used a daily weather simulator (Régnière and Bolstad 1994) to estimate fire weather index (FWI) values associated with GCM climate change projections for 14 locations in BC. Projections of potential wind damage by Curry used the Canadian Regional Climate Model to tabulate the 95th percentile of surface wind speeds. In looking at the geographic patterns in historic disturbances and their projected trends, we chose to summarize all results by ecoprovince, a scale of ecological land classification intermediate between ecoregions and ecozones. This same scale was independently derived by collaborators (Boulanger et al. 2012) as the most useful scale for fire regime classification across Canada."

The fire regime projections completed under this portion of the project indicate that resource managers and community leaders in the southern half of the province should prepare for an increase in the risk of severe fires. The balance of ignition frequency, area burned, and fire season is likely to shift to unprecedented combinations in much of the province, suggesting the need for managers to be watchful and flexible as such changes unfold.

Extension of research outcomes:

Extension of the research outcomes from this project have been accomplished through publications and through participatory events such as webinars.

Decision Support Framework

Extension of the decision support framework itself was accomplished, in part, through the webinar presentation on May 5, 2012 as part of the Future Forest Ecosystem Scientific Council webinar series. In addition the framework was shown in action through a pair of silviculture dialogue sessions that were held in the fall of 2011. Guy Burdikin (West Fraser Timber and member of the WL TSA Silviculture Subcommittee) described to 26 participants the work they were doing to address some seed planning policy issues and Suzan Lapp (FORREX) and Trevor Murdock (PICS) used the framework as the basis for their presentation on Climate Modelling and Silviculture Decision Making which was attended by 22 participants.

Also, as mentioned in the Research outcomes section, a discussion paper on the Decision Support Framework has been published in the BC Journal of Ecosystems and Management.

Topical Syntheses

In addition to the BC Journal of Ecosystems and Management and FORREX series publications (previously described), the topical syntheses information has been extended through several workshops and webinars.

A series of 4 workshops were held in June in Prince George, Nanaimo, Smithers and Nanaimo at which discussions sheets for each of the Topical Synthesis areas as well as the Disturbance Regime Analysis work were presented and discussed. Input received from the 41 early adopters at these sessions was also used to improve the topical syntheses.

The following webinars were also held. Many of these webinars were also recorded and have been made available on the FORREX website to increase the effectiveness of these activities in extending the results of this project.

Human Dimensions

November 17, 2011. Increasing the resilience of rural communities to natural disturbance and climate change. Presenters: Ajit Krishnaswamy and Ellen Simmons (FORREX) (*Presentation and recording available on-line for download – contact Aji.Krishnaswamy@forrex.org for access*)

Forest Carbon

Feb 1, 2012. What silviculturists should think about when managing for carbon as part of their objectives. Presenter: Caren Dymond (BC Ministry of Forests, Lands and Natural Resource Operations) (*Presentation and recording available on-line for download – contact Kathie.Swift@forrex.org for access*)

Feb 8, 2012. Carbon Management Pilot projects – an update. Presenter: Cam Brown (Forsite Consultants Ltd) (*Presentation and recording available on-line for download – contact Kathie.Swift@forrex.org for access*)

Feb 15, 2012. Update on new carbon features in TIPSY and FAN$IER. Presenter: Mario De Lucca (BC Ministry of Forests, Lands and Natural Resource Operations) (*Presentation and recording available on-line for download – contact Kathie.Swift@forrex.org for access*)

Biodiversity

Feb 28, 2012. Fire ecology and forest/grassland interface. Presenter: Don Gayton (FORREX)

Forest Succession

A series of webinar on this topic was proposed as part of a project with the Ministry of Forests, Lands and Natural Resource Operations but has been postponed. It is expected that the series will be delivered in the new fiscal year.

Disturbance Regime Analysis

In addition to presenting the discussion sheet on the disturbance regime analysis work at the 4 workshops, a presentation on the work was given by Dr Phil Burton to approximately 60 participants as part of the Natural Resources and Environmental Studies Institute Colloquium series at the University of Northern British Columbia. The presentation 'Classifying and Mapping Forest Disturbance Regimes' was also webcast although it was not recorded.

Literature Cited

Boulanger, Y., Guathier, S., Burton, P.J., and Vaillancourt, M.-A. 2012. An alternative fire regime zonation for Canada. International Journal of Wildland Fire 21: in press.

Burton, P., Y. Boulanger, B. Pettit, G. Thandi, and S. Taylor. 2011. Classifying and Mapping the Forest Disturbance Regimes of British Columbia. Presented the 7th International Conference on Disturbance Dynamics in Boreal Forests (May 30, 2011, Saguenay, Quebec).

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

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