Ecosystem Management Emulating Natural Disturbance Project

2012 Annual Report

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1) Executive Summary

Renewal and synthesis were the key foci of the EMEND program in 2012, and we feel strongly that we have achieved our goal of renewing the momentum established at EMEND over the past 15 years.

A major highlight of the 2012 year was development of our NSERC Collaborative Research Development (CRD) grant application, which has been successful in winning a national competitive funding award. These funds from NSERC in conjunction with cash and in-kind support from Daishowa-Marubeni International, and in-kind support from Canfor, will provide a total of ~$1.7 million to the EMEND graduate program. This is a significant award and recognizes the valuable and high-quality role that EMEND plays, not only to the various industry and government partners, but also to the national and international science communities. We also were successful with an application to the University of Alberta in support of infrastructure resources for EMEND. This grant of $115,750 will help to cover the purchase of two new quads, five tents for the EMEND camp, and support our program manager role for the next three years.

A new cohort of graduate students began their programs at EMEND in 2012. Sonya Odsen and Jared Amos began their projects at EMEND and both had successful field seasons and achieved their data collection goals. In addition to starting off these new students, we saw five graduate students successfully complete their programs Dr. Colin Bergeron successfully defended his work on the fire history at EMEND and landscape level indicators of biodiversity; Charlene Wood completed her M.Sc. thesis on beetle assemblages associated with aspen deadwood; Esther Kamunya finished her work about the moth assemblages at EMEND; Dr. Matthew Swallow completed his work which looked at the soil microbial communities in boreal forest stands; and Dr. Irma Diaz completed her work looking at the belowground mite community at EMEND. Furthermore, Marla Schwarzfeld (parasitoids at EMEND) and Seung-Il Lee (beetle assemblages associated with spruce deadwood) also moved their graduate projects closer to completion. Several other new students, including Linhao Wu, who will work on carbon modeling and biodiversity predictions, are likely to make good use of the EMEND data in their work.

We also made significant progress on the EMEND synthesis project thanks to the efforts of Dr. Jaime Pinzon, Dr. Colin Bergeron and Kevin Solarik. Together they have been developing chapters summarizing the biodiversity findings at EMEND, a description of the EMEND landscape, and chapters describing the EMEND experimental structure, silvicultural findings and productivity related findings respectively. These chapters and others will continue to be developed during 2013 with a book publication being the target end product. This work has

been made possible thanks to financial support from the Alberta Government in the form of a three year $500,000 Legacy grant provided to EMEND.

Finally, the 2012 year saw the renewal of two key pieces of the EMEND program: the website and the safety program. We successfully launched a revamped website in June of 2012 with a focus on better communicating the work at EMEND to a broad audience (www.emendproject.org). We also undertook a ground-up review of the EMEND safety program that we are in the process of finalizing. Thanks to the help of Mr. Gord Winkel, past VP of Environment, Health and Safety at Syncrude Canada Ltd and now with the Faculty of Engineering at the University of Alberta, we believe this renewed safety program will be an industry-leading safety program for EMEND. It is certainly going to be a model for field research programs at the University of Alberta, continuing the local tradition of EMEND leadership in this area.

The positive renewal of both students and funding to the EMEND program in 2012 leaves us with much optimism about the years ahead. We look forward to continuing to develop leading edge science that can be used to guide effective forest management in Alberta.

2) EMEND Project Introduction

The Ecosystem-based Management Emulating Natural Disturbance (EMEND) project, a valuable resource remotely located NW of Peace River, Alberta, Canada, is a large-scale (1000 ha) variable retention forest harvest experiment set within a 7000 hectare area of FMA tenure protected for long-range research. EMEND was originally designed to answer questions about how retention of green-tree residuals affects harvest cost, forest regeneration, patterns of succession, biodiversity, nutrient cycling, ground water characteristics and public perception. The EMEND resource comprises an 'experimental site' and a 'remote field research facility' (camp field lab). It is, we believe, the largest single site-manipulative forestry experiment in the world.

The experimental site that is the heart of EMEND was planned in 1996-97, laid out in previously unharvested forest in 1998-99, and developed through large industrial and public investment. It is planned to support world-class research activity for at least one stand rotation, or approximately 80-100 years. The experiment allows scientists to study a real working industrial forest from initial harvest through a first rotation harvest, thereby, providing insights into processes over an entire woodland life cycle on the western boreal plain.

The research at EMEND consists of two components: 1) a core research program that is designed to elucidate long-term (i.e., 10+ years) patterns of response to disturbance on the

research site and to answer questions defined by industry and government partners; and 2) a graduate student program that seeks to answer a broad range of scientific questions about the responses of biodiversity, productivity, and social values to variable retention harvesting through original scholarly research conducted at EMEND. Work under component #2 connects EMEND to a vibrant international research culture, while that under component #1 assists industry directly with development toward objectives that can be defined today and are set in the context of the present operating rules and policy for forestry in Alberta. Taken together these efforts comprise the double edges of the R&D sword, which we aim to keep as sharp as possible, given the resources available.

EMEND continues to inform management applications and policy that together strive to balance social, environmental and economic values, thus remaining relevant across northern boreal landscapes. While the program's roots were founded in forest management questions, the fundamental knowledge of boreal ecosystem species, functions and structural components holds distinct value beyond the forest sector and will be of significant value to any group attempting to manage boreal forest land, including the energy sector. The research site is readily accessible by all-weather forest road for monitoring and demonstration purposes. It consequently enjoys regular visitors as well as growing national and international reputation for its design, credibility, long-range view and its longevity as a model partnership of industry, government and academic collaborators.

The following sections provide an overview of both the core research program, and the graduate student research program at EMEND in 2012.

3) Core Activities

Core Activities Summary- 2012

During the past year of core research we have:

1. Processed and identified all ground beetle specimens from the 10 year re-measurement.
2. Collated and entered all outstanding core data for use in future analyses – building on work undertaken by Kevin Solarik and Jaime Pinzon.
3. Advanced the EMEND 10 year synthesis book via the collective efforts of Jaime Pinzon, Colin Bergeron and Kevin Solarik. Please see below for brief overviews of the work completed on these synthesis chapters to date:

Jaime Pinzon – Ph.D and Postdoctoral fellow – Responses of biodiversity to variable retention harvest: a 10-year tale *(please note Jaime's salary is being covered under the NSERC-CRD program, however a core component of his work is focused on developing the synthesis project)*

As part of the EMEND 10 year synthesis project, I am leading the Biodiversity component. Initially it was envisioned as a single chapter summarizing the main results during this time frame based on the experiment wide collected data, namely, arthropods (carabid/staphylinid beetles, moths and spiders), vascular and non-vascular plants, birds and additional data of a variety of taxonomic groups collected mainly by various MSc and PhD students. Now, given the complexity of data available, it is most likely that this chapter will be split into two main sections, one describing the major patterns and other as an annotated species list. During this year I have been compiling and organizing data available from different sources. This has proven quite challenging, given the amount and quality of these data. In addition to assess the effect of variable retention on these taxonomic groups, a main component is to consider the temporal change. However, this has been extremely demanding, given consistency of the data. For instance, only data are available for carabid beetles and vascular plants for the 10-year period (2000, 2004 and 2009). For spiders data have been collected for all years but unfortunately the 2000 portion is unavailable; similarly, for staphylinid beetles only collections from 2000 are identified whereas for non-vascular plants data from 2009 are not identified (until last summer a student was hired to enter the 2009 vegetation data, but to this date most of the bryophytes are unidentified).

In addition to these activities, I have been working on a larger scale GIS analysis of niche modeling (also known as species distribution modeling). Using the EMEND core data (geo-referenced species records collected from the EMEND landscape) and environmental variables obtained from various sources (thanks to DMI that provided some valuable core data), I am in the process of predicting suitable habitat for a large number of species of different taxonomic groups within the forest management area the EMEND project is embedded in. This will provide an initial approximation of potential biodiversity hotspots and preliminary predicted distribution maps of selected species within this FMA.

Colin Bergeron – Ph.D – EMEND Synthesis Chapter: The EMEND Landscape

I initiated work on a chapter for the EMEND synthesis focused on describing the EMEND landscape. For this chapter, I started the analysis of data retrieved from the EMEND database, assisted Rick Pelletier at the University of Alberta in developing a data repository for the georeferenced images from EMEND, and started writing. I also started the analysis of a dataset about ants (also unstudied at EMEND so far) and included the results in an invited talk at the Annual Meeting of the Entomological Society of Canada. The talk was a synthesis of the association between ground dwelling arthropod (ground beetle, rove beetle, pill beetle, spiders and ants) and the ecosites of Alberta.

Kevin Solarik – M.Sc – EMEND Synthesis Chapters: Experiment Chapter, Silviculture Chapter and Productivity Chapter

Experiment Chapter

To date a rough draft of the experiment chapter has been compiled. The chapter begins outlining the initial deliberation of the project and how the first ideas were developed (1995-1997). This section is followed by a description of how the stands at EMEND were selected and initially assessed (1997-98) to be used in the final project. An overview of the experimental design (canopy composition, harvesting and fire treatments) is then detailed. The permanent sample plots are discussed and outlined as they have been used by many of the research projects conducted at EMEND. A short section on the type of research is also included in the chapter to offer the reader insight on the different people who have been included in the research at EMEND. There still remains two sections that need to be completed to finish the chapter. The first is a section that discusses the various analytical and statistical approaches that have been used at EMEND to better interpret findings (discussions felt this section was best to be done after the chapters were all completed). The second is to include a section discussing the basis and structure of the database and how the data collected at EMEND has been, and is, managed.

Silviculture Chapter

A revised edition of the silviculture chapter has been completed and requires minimal edits to reach final product. The chapter includes a definition of silviculture and an overview of silviculture in Canada. The chapter then outlines what harvesting procedures were used and why. The permanent plots established within the project and all silviculture based plots (i.e., windthrow plots, planted spruces) are then described and outlined. All major silviculture based research conducted over the time since harvest have been introduced and summarized in this chapter. Each projects data was re-organized, further analyzed and results are presented in this chapter. The results, however, are organized based on major tree species (i.e., white spruce and aspen).The chapter concludes with the associated costs of implementation of the harvesting practice.

Interesting Conclusions/Results

- There is good natural regeneration of white spruce, while residual trees were not necessarily needed in great numbers to produce regeneration.
- Natural regeneration of white spruce did quite well overall without any vegetation control.
- Planted white spruce were found to be about 1m taller than natural spruce seedlings by year 10.
- Natural regeneration of Aspen was overall very good, however declined with increasing residual intensity.
- Retention of a high level of residual trees is not needed to attain high levels of natural regeneration for both aspen and white spruce, however, soil disturbance is critical.

Productivity Chapter

The chapter remains in a rough draft and requires some input regarding which angle is going to be taken considering the overall message of the chapter. To date, the chapter begins with an introduction of why this chapter is included in the synthesis work and offers insight to the importance of assessing productivity in terms of biomass. The next section introduces the definition of productivity in terms of forests/plants and the idea of biomass. An overview of the shrub plots is then described as with the permanent tree plots, followed by the research projects that are assessing biomass (i.e., shrub harvesting and assessment, tree and root measurements). Research results are then discussed, however the chapter still requires a concluding statement.

Interesting Conclusions/Results

- Over 80,000 specimens recorded.
- Overstory canopy composition only had a significant impact on shrub biomass after 2010 measurements, where DDOM stands were significantly higher than CDOM stands.
- Retention intensity was found to have a significant impact on shrub biomass in 2005, 7 years after initial measurement.
- Tree biomass was only impacted by overstory composition and not retention intensity.

Core Activity Financials- 2012

Funding support for the 2012 Core activities at EMEND was provided by Alberta Sustainable Resource Development Legacy Funding- administered through the Foothills Research Institute.

FRI Funding - AESRD Legacy Funds			
Reporting Period April 1, 2012 - December 31, 2012			
	2012-2013 Budget	**2012 Actuals to Date**	**2013-2014 Budget**
Salary/Benefits			
Field Coordination/Administration	$ 52,000	$ 54,316	$ 35,000
Summer Core Crew/Data Entry	$ 20,000	$ 13,422	$ 20,000
Lab Tech (Taxonomy and Grad Support)	$ 22,000	$ 22,000	$ 22,000
Data Analyst (Solarik/Bergeron)	$ 60,000	$ 44,935	
Sorting/Identification	$ 9,000	$ 3,393	
Salary/Benefits Sub-total	*$ 163,000*	*$ 138,066*	*$ 77,000*
Other			
Camp Costs (Coordinator + Core Work)	$ -	$ -	$ 8,350
Lab & Field Supplies	$ -	$ -	$ 11,500
Vehicle Rentals & Maintenance	$ 2,500	$ 4,331	$ 2,500
Facility Maintenance and Utilities	$ 6,500	$ 2,778	$ 6,500
Equipment Upgrades	$ 500	$ -	$ 2,500
Other/Hosting	$ 500	$ 1,321	$ 2,000
Core Sub-total	*$ 10,000*	*$ 8,431*	*$ 33,350*
Expenses Sub-total	*$ 173,000*	*$ 146,497*	*$ 110,350*
Over-expenditures in 2011-2012	*$ -*	*$ 13,451*	*$ -*
Total Expenses	**$ 173,000**	**$ 159,948**	**$ 110,350**

Planned Core Activities - 2013

Core activities slated for 2013 include:

1. Completion of the prescribed burns at the EMEND site. As conditions permit, we plan to focus on completing any outstanding burns on the EMEND site (See Appendix 1).

2. A small core crew consisting of a crew leader and an assistant will be hired to re-mark the baselines at EMEND, and prepare the various quad trails for increased use over the coming years. Efforts will be focused on building bridges and clearing trails for future use.

3. EMEND synthesis chapters will continue to be a major focus of our core activities in 2013. The following summarizes the proposed timelines for chapter completion:

Chapter 1: ***Introduction,*** An advanced draft to be tabled by 1 June 2013.

Chapter 2: ***The EMEND Landscape***, A final draft of this chapter will be tabled by 1 June 2013.

Chapter 3: ***The Experiment***, An advanced draft is in hand; final draft will be tabled by 31 March 2013.

Chapter 4: ***Productivity & Silviculture***, An advanced draft is in hand; a final draft of this chapter will be tabled by 31 March 2013.

Chapter 5: ***Biodiversity***, An advanced draft is expected by 31 March 2013.

Chapter 6: ***Coarse Woody Material (CWM)***, Two manuscripts (Williams et al.) are in final stages of preparation for publication. These will form the basis of the chapter. We plan active work on this chapter during 2013, with the expectation that a draft chapter can be tabled by 1 September 2013.

Chapter 7: ***Soils and Nutrient Fluxes***, We expect to develop the approach for this chapter and to begin the data consolidation work for this chapter during 2012-13. A base manuscript (Kishchuk et al.) is now under internal pre-submission review in the CFS in-house system, and the chapter will grow from this. We plan to table an advanced draft of this chapter by December 2013.

Chapter 8: ***Forest Health & Dynamics***, We expect to begin the data consolidation work for this chapter during 2012-13, and to table an advanced draft of this chapter by February 2014.

Chapter 9: ***Synthesis, Conclusions & Recommendations***, We expect to deliver a reasonably final draft of this chapter by February 2014.

4) Graduate Studies Activities

Graduate Student Activities - 2012

EMEND provides an invaluable educational opportunity for domestic and international post-secondary graduate-students offering them simultaneous exposure to policy and management challenges associated with the Canadian boreal forest across-sectors, through interaction with all partners during the course of their research. The 2012 year saw a number of successful thesis completions by students that had undertaken research projects at EMEND. These included:

Colin Bergeron – Ph.D – Fire history, landscape biodiversity and indicators for sustainable management of the boreal mixedwood forest

The year of 2012 started with the official completion of my PhD thesis entitled "Fire history, landscape biodiversity and indicators for sustainable management of the boreal mixedwood forest". In my thesis, I use field and remotely sensed data in order to prove that considering landscape history in the elaboration of conservation strategies for the extensively managed portion of the boreal forest will foster preservation of biodiversity. I also published a second scientific paper out of this thesis which focuses on the use of provincial forest inventory data and ecosystem classification maps as surrogates for landscape biodiversity (Bergeron et al. 2012. Journal of Plant Ecology, 5(1):97-108). This paper demonstrates that it is possible to use provincial forest inventory data (Alberta Vegetation Inventory) or ecosystem classification maps in order to provide not only a timber value, but also a biodiversity value for each stand of the landscape under management. I also published a third paper out of my thesis in *The Canadian Entomologist* which examined more closely the use of ecosystem classification (ecosite of Alberta) as a surrogate for ground dwelling arthropods including carabids, staphyinids and spiders. This paper points out species from these three taxa that have a strong potential as target organisms in biodiversity monitoring.

I also made a major contribution to a paper published by G. Blanchet that examines the effect of anthropogenic disturbance, spatial autocorrelation and habitat heterogeneity on ground beetle assemblage (Blanchet et al. *In press*. Ecography, DOI: 10.1111/j.1600-0587.2012.07762.x). In this paper, we prove that at the scale at which forest industries operate, the spatial autocorrelation in the ground beetle assemblage is mostly controlled by environmental variables. Thus, conservation strategies in forest under management should be based on habitat parameters. We also prove that the overall effect of anthropogenic disturbances covering about 27% of the EMEND landscape has no effect on the spatial structure of the epigaeic fauna in forest that remains undisturbed. This means that it is possible to exploit a certain portion of the forested landscape (at EMEND between a third and a quarter) without negatively affecting the community inhabiting the remainder of the forest.

In 2012, I also worked on other scientific papers including the description of a new species and the habitat association of pill beetles (a group unstudied at EMEND so far) which are both near submission for publication.

Charlene Wood – M.Sc. – Beetle assemblages associated with aspen deadwood in broad-leaved boreal mixedwood stands

On September 18, 2012 (degree conferred Nov 2012) I successfully defended my thesis. My thesis was 234 pages, consisting of an introductory chapter, three data chapters, a discussion chapter, and an appendix compiling species-specific ecology information. In my thesis, I addressed three main questions:

1) What collection method or combination of methods is most suitable to provide a robust sample of saproxylic (i.e., deadwood-associated) beetles and/or to assess substrate-associations?

I compared six different collection methods used to sample saproxylic beetles from various aspen habitats. Knowledge of collection method performance and species-specific collection biases will be useful to design future studies and monitoring programs. Collection method had a greater effect on the structure of beetle assemblages than did differences in substrate type, decay class, surface area, volume, and sampling time. Although hand collection has rarely been employed in saproxylic beetle studies, I found it to be the most productive method, providing efficient species accumulation, high catch of target species, and low sorting time and cost to setup in the field. I found strong support for using modified Tulgren funnels to sample beetles from the wood fragments remaining after hand collection, as funnels extracted a large number of species that would have been missed otherwise. In short, the funnels were very practical for deriving diverse samples in a short time. While window traps were also efficient at collecting a large number of saproxylic beetle species and have been widely employed in studies of saproxylic insects, they also collected many non-target organisms which inevitably translates to increased laboratory time for sample sorting. Additionally, window traps may be unsuitable for studies wishing to assess ecological associations, such as effects of habitat quality, as this was the only collection method that was insensitive to habitat and collection variables (substrate attachment, decay class of substrate, sampling time, etc). In chapter two, I also demonstrated that catches of many species are biased by particular collection methods, and that such biases were strongly associated with window trap samples. Overall, my work suggests that collection method(s) should be carefully chosen in relation to the goals of particular investigations, as different methods may profoundly influence the results of individual studies.

2) How do saproxylic species and assemblages respond to the size of logs?

I examined responses of saproxylic beetles to diameter of fallen aspen deadwood, in four size classes: 7 to <16 cm (SC 1), 16 to <25 cm (SC 2), 25 to <34 cm (SC 3), and 34 to 43 cm (SC 4). All size classes housed saproxylic beetles. Although small diameter logs were more abundant in deciduous stands, fewer saproxylic beetles were found to use <16 cm diameter logs and assemblages differed significantly between logs greater or less than 25 cm in diameter. Furthermore, more species were positively associated with ≥25 cm diameter logs than smaller logs. Mean trophic richness of saproxylic beetles also increased, non-significantly, with size class. It is possible that these patterns of habitat use could be

driven by differential predation across log size classes, as large diameter logs exhibited lower predator density. Larger substrates might also provide longer habitat persistence, more stable microclimate, different fungal communities/decay dynamics, increased heterogeneity of microhabitats, or other unique conditions. These results verify that the size (e.g., diameter) of deadwood substrates is an important element of habitat for the saproxylic community. Overall, large (≥ 25 cm) diameter logs appear to be of particular importance.

3) What are the habitat types and deadwood attributes associated with saproxylic beetles and how do assemblages vary across different substrates?

I assessed saproxylic beetles across various habitat qualities. Previous studies have been largely biased towards early successional taxa (bark- and wood-boring beetles) and freshly dead wood, and thus the full community of saproxylic beetles had not been sampled across a wide range of aspen deadwood decay classes in standing and fallen wood. Such an assessment of the saproxylic community is needed to fully understand our fauna and the habitat associations of North American taxa.

Substrate type (live trees, snags, and logs) was an important determinant of saproxylic beetle assemblages. Although live trees did not host any unique species, they supported an amount of diversity that was surprisingly similar to that found in the decay classes of snags. These saproxylic beetles found in live trees provides evidence for expanding the known habitats of saproxylic species into live (potentially fading) trees. Although richness estimates per individual and volume sampled were lower for snags than logs, these substrate types clearly house quite distinct beetle assemblages. Decay class, percent bark cover, and moss presence were also strongly correlated with patterns in ordinations of the saproxylic beetle community. Species composition was most similar between adjacent decay classes within each deadwood habitat type. A large number of species (87 species) were significant indicators for particular deadwood qualities, most notably decay class. Few species were found to be dominant in the overall saproxylic beetle community associated with aspen habitats, but instead, the dominance of many species sharply declined in adjacent decay classes of a particular substrate type. Evidently, saproxylic beetle species exhibit a high-degree of specificity for particular decay classes. Additionally, logs with fungal fruiting bodies host distinct assemblages which include ‘minute tree-fungus beetles’ of the family Ciidae. Thus, conserving a variety of deadwood habitats with a range of qualities seems to be required to effectively conserve the saproxylic fauna associated with aspen.

As a whole, my thesis also provides significant improvements to our biodiversity knowledge. Forty-seven species were newly recorded in the province of Alberta, while seven species were confirmed to be new to science (descriptions forthcoming). An additional species is considered likely new to science. Habitat associations were determined for a number of species for which there was little-to-no quantitative data available. Two (non-saproxylic) ground beetles (Diacheila arctica amoena and Perigona nigriceps) were collected in our study area, representing significant range extensions of >1500 km.

In conclusion, a wide range of substrate types, decay classes, and sizes are important saproxylic beetle habitats. The particular deadwood associations revealed in this study may be relevant in developing surrogates for biodiversity monitoring, forest management protocols, and/or conservation plans.

Esther Kamunya – M.Sc. – Conservation of boreal moth communities in the mixedwood boreal forests of northwestern Alberta: Impacts of green tree retention and slash-burning

Green tree retention (GTR), which involves leaving dispersed or clustered live trees on harvested stands, is being adopted as an alternative to clear-cutting, and to conserve biodiversity on managed forests. This thesis examines the post-harvest (7-10yrs) recovery of boreal moths following retention harvest and slash-burning in the managed mixedwood boreal of northwestern Alberta. Night-flying moths were light-trapped from coniferous (CDOM) and deciduous (DDOM) stands harvested to three retention levels (10%, 20% and 50%), stands harvested to 10% retention and burned (slash-burns), and un-cut control stands. At the 50% retention level, moth communities of the DDOM cover-type did not differ from un-harvested stands, but those of the CDOM cover-type were still very different, 8-yrs post-harvest. Retention at the 20% level was insufficient to promote the recovery of moth communities on harvested stands of both cover-types. The abundances of moths that feed on pioneer plant species in their larval stages were increased while feeding specialists were decreased at both levels of retention. Thus, higher levels of retention are likely required in order to conserve feeding and habitat specialists in the managed mixedwood boreal.

Retaining single dispersed trees of different species, size and age classes on harvested blocks may therefore help to maintain populations of specialized feeders, albeit in low abundances, through the stand regeneration cycle. Burning slash after harvesting did not promote the recovery of moth assemblages different from that found in low (20%) retention harvest, 8-yrs post harvest, but both forms of disturbance greatly reduced moth abundances and richness compared to unharvested controls. It is likely that fire behavior and intensity is modified in stands where low retention levels have been applied. Hence, prescribed burning will better achieve conservation objectives as complements to high retention or unharvested forest stands.

Matthew Swallow – Ph.D – Soil microbial communities in the boreal forest

Soil microbial communities in boreal forests are dependent on complex interactions among many known and unknown factors. These interactions operate simultaneously on large and small spatial scales. Of note, trembling aspen and white spruce forest floors show distinct differences in their microbial communities. This thesis highlights linkages between ecosystem characteristics observable on the landscape and microscopic processes occurring within boreal forest floors.

As indicated by phospholipid fatty acid (PLFA) and multi-substrate induced respiration analysis, prescribed burning after harvesting did not alter microbial community structure and function in aspen, spruce and mixedwoods stand. Instead, community structure was related to the pre-harvest overstory and topography with aspen being different than similarly structured spruce and mixedwoods in sites located at lower landscape positions. Microbial communities in spruce forest floor were similar regardless of the amount of moisture retained throughout the incubation, while in aspen, community structure was dependant on the level of moisture. Microbial community response to moisture in aspen and spruce was linked to the different physical properties and subsequently, the pore habitat, inherent to the two forest floors. Microbial community structure in aspen leaf litter inoculated with forest floor

bacteria is altered when ciliates are present. Ciliates moderated the growth of gram negative bacteria, potentially grazed on fungi and promoted bacteria that consumed plant auxins.

Forest floor microbial communities are shaped by the pore habitat generated by the litter of the plant community and predatory activity of protozoa. However, being aquatic organisms, protozoa can function only when suitable water filled pore habitat is available. On the landscape these processes are dependent on factors such as topography to redistribute moisture. Under these circumstances, difference between the physical properties of aspen and spruce forest floor manifest and influence the microbial communities residing within.

Irma Diaz – Ph.D – The belowground mite community at EMEND

On October 2nd 2012, we submitted a paper for publication in Forest Ecology and Management. The title of this paper was: Influence of cover-type on predatory mite (Mesostigmata) assemblages from the forest floor in western Canadian boreal mixedwood forests. The paper corresponds to Chapter III of my thesis.

On December 20th 2012, I presented my exam to obtain my PhD degree in the Department of Renewable Resources in the University of Alberta and it was approved. The thesis title was Structure, composition and trophic ecology of forest floor predatory mites (Mesostigmata) from the boreal mixedwood forest of northwestern Alberta. My Supervisors were Dr. Sylvie A. Quideau and Dr. Barbara Kishchuk

The abstract of my thesis is included here: The forest floor, including the L, F and H horizons is the habitat for numerous soil fauna whose ecological relationships affect various soil processes. The forest floor is closely associated with stand development in boreal mixedwood forests from deciduous to mixed to coniferous stands, creating distinct biochemical and physical characteristics within the different organic layers. Under the premise that forest floor soil communities are closely associated with, and characteristic of a particular cover-type. I used predator mites (Mesostigmata) dwelling in forest floors to study the impact of forest cover-type on the structure and composition of these mite assemblages.

Differences in species richness, dominance and assemblages were a consequence of forest cover-type. Results further demonstrated the importance of coniferous trees in structuring mesostigmatan assemblages. Forest floor pH structured variation in mite assemblages and forest floor thickness were associated with habitat preferences. Thus, the variation in habitat changes from early seral stages to mature old-growth stands results in diverse predatory mite assemblages. A particularly interesting feature of the fauna was the great diversity of zerconid species of genus *Mixozercon* (Halašková, 1963), including *M*. *albertaensis*, *M*. *jasoniana* and *M*. *borealis*, species that are exclusively found in western boreal forests.

I used nitrogen isotope analysis (δ^{15}N values) to assess the trophic positions of mesostigmatan and some oribatid mites in relation to potential effects of forest harvest on soil food webs in coniferous and deciduous stands. The differences in δ^{15}N separated the mites in three main trophic guilds: detritivores (only oribatid), omnivores (overlapping with predators) and predators. Each guild was further

subdivided into subguilds based on feeding relationships. Isotopic nitrogen fractionation within the mites did not seem to be affected by their habitat (spruce vs. aspen) or by clearcutting. Instead, the well-defined degree of isotopic fractionation observed within the food web may depend only on the predator-prey feeding relationships because the degree of isotopic enrichment (or depletion) of predator reflects its diet.

In addition to these completed theses, other students moved their projects closer to completion. These students included:

Sonya Odsen- Boreal bird response to variable retention harvest over time

Bird surveys have been performed at EMEND at regular intervals throughout the project: a crew sampled all compartments before and after harvest (1998-2000)[1], and another crew sampled all cutblocks 7 years after harvest (2005-2006). One of the main goals of my Master's thesis is to follow up on these surveys, 14 years post-harvest, to assess how boreal bird communities recover from different levels of harvest over time.

My first field season at EMEND lasted from late May to early August, 2012. Following the procedures of past crews, I performed bird surveys in each harvested and control compartment, excluding the burned and slash compartments due to time constraints. Following the conclusion of surveys at the end of the breeding season (end of June), I conducted coarse-scale surveys of vertical cover and canopy cover at sampling points, as well as assessments of ellipses where they overlap with point count areas.

I have completed data entry and error checking, and have conducted preliminary data exploration and analysis for each year of data. Preliminary results have shown that retention level had a significant effect on species richness in the 2 years immediately following harvest (1999-2000), but that species richness was not affected by retention level in later years. Interestingly, species richness visibly increased following harvest, although the significance of this trend has yet to be tested. Species communities demonstrate a treatment effect for all years following harvest, however pairwise comparisons show that the primary differences are between clear cuts and controls. These findings suggest that tree retention mitigates the effects of harvest, and that low retention and high retention do not significantly differ in their effects on bird communities.

Further analyses to the existing dataset will include repeated measures analysis to assess trends over time, and the inclusion of cover type and environmental variables (using EMEND core crew data) to more specifically assess the relationships that may explain trends in bird communities. A second field season will be conducted in order to maintain a more robust dataset, as two years' consecutive surveys will be less sensitive to natural annual population fluctuations.

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[1] Harrison, R.B. 2002. Stand-level response of boreal forest songbirds to experimental partial-cut harvest in northwestern Alberta (Master's thesis). Available from Education and Research Archive, University of Alberta http://hdl.handle.net/10402/era.21792.

Additional research questions have yet to be finalized, but a number of ideas were formed during the 2012 field season. In 2013 I will try, time permitting, to sample the burn and slash burn compartments in order to contribute to a more complete EMEND database, and potentially analyze these data by comparing them to harvested compartments. I am also interested in critically reviewing the effectiveness of conventional point count methods by comparing observer effects and (if the opportunity arises) song recognition technology.

Seung-Il Lee – PhD candidate – Influence of variable retention harvesting and dead wood characteristics on saproxylic beetles in boreal white spruce stands

Saproxylic beetles (i.e., beetles that depend on dead or dying wood during some part of their life cycle) are a diverse group of organisms that are well known to be threatened by traditional forestry activities. The goal of my research is to understand how dead wood characteristics and variable retention harvesting influence the composition and diversity of saproxylic beetle assemblages in white spruce coarse woody debris (CWD) in boreal forests.

During the 2012 field season at EMEND, I tried to finish my last experiment. The objective is to identify saproxylic beetle species that initially colonize two types of spruce CWD (logs and snags), and evaluate the role of aggregated retention patches in influencing early colonization of saproxylic assemblages in mixed wood forest. For this study, living white spruce trees were cut in the two sizes of aggregated retention patches (0.20 and 0.46 ha) within matrices of different retention levels (2, 20, 50, and 100% canopy retention) in mixed wood stands in 2010. Two 120 cm long sections were cut from the base of each felled section; one left on the forest floor as a 'log', and the other propped up against a nearby live tree as a 'snag'. During the summer of 2011, a 60 cm wood bolt was cut from each simulated log and snag, and placed in an individual rearing drum near the EMEND camp. The remaining CWD sections were similarly sampled in 2012. Saproxylic beetles emerging from rearing drums were sampled five times during the summer.

Aside from the field work, I have been trying to identify all the saproxylic beetles that I have caught during the 2009-2011 field seasons at EMEND. More than 50,000 beetles representing roughly 350 species were identified including newly recorded species at EMEND. Among other projects that I have studied, I found that beetle species composition was different among various decay classes of spruce CWD, suggesting conservation of the full range of decay classes of downed deadwood is critical for maintaining the pre-harvest diversity of saproxylic beetles. Another interesting finding is about thresholds in aggregated retention patch size within harvest blocks. I found that retention patches preserve populations of saproxylic beetles well, even 10 years after harvesting. However, at least medium sized patches (1.6-3.6 ha) are recommended to conserve intact spruce forest communities.

Marla Schwarzfeld – Ph.D Candidate – The Ichneumonidae of EMEND

Ichneumonidae are parasitic wasps (parasitoids) that lay their eggs in or on other arthropods. As such, they play an important role in the population regulation of a wide variety of species, particularly among Lepidoptera and Symphyta. In this study, I collected Ichneumonidae from a range of treatments in decidous-dominated stands at EMEND (control, 50% retention, 20% retention, clearcut), 8 years post-

harvest. I identified over 47,000 specimens to subfamily, and then focused on three subfamilies (Pimplinae, Poemeniinae, and Rhyssinae) for species-level identifications. The field work and identification of specimens for this project are complete. I am currently in the process of completing analyses of these data, and preparing the results for publication. In 2012, I published a contribution to the EMEND Insights series: "Gatekeepers of the forest: the ichneumonids of EMEND" by Schwarzfeld and Sperling.

In this study, I collected an average of 66 specimens of Ichneumonidae per trap-day; this is one of the highest abundances of Ichneumonidae recorded from Malaise traps. I estimate that there are well over 500 species of Ichneumonidae at EMEND, however taxonomic difficulties (lack of identification resources, undescribed species, etc.) render many of them very difficult to identify. From the three target subfamilies, I identified 64 species (3,878 individuals), all of which are newly recorded from the EMEND landbase. Thirteen species are new records for Alberta.

There was an overall increase of Ichneumonidae as green-tree retention increased. This pattern was strongest in three subfamilies (Ichneumonidae, Pimplinae and Cylloceriinae), and in one species of Pimplinae (*Dreisbachia slossonae*). Some of the remaining subfamilies and species showed a similar pattern, while others varied randomly with respect to treatment. No species or subfamily showed the reverse pattern (i.e. a greater affinity for clearcuts). This study indicates that green-tree retention can be a valuable tool for maintaining parasitoid numbers on the landscape, and thus potentially reducing the impacts of forest pest species.

Jared Amos – M.Sc. Candidate - The effect of retention harvesting on pollinator population assemblages in the boreal forest of Alberta

The goal of 2012 was to determine what species of pollinators are present in the boreal forest of Alberta, how their populations differ with forest type, and experiment with different sampling techniques. We sampled all the 100% retention controls stands in order to determine how population assemblages differ with forest cover type. The 50% retention treatment in the deciduous dominated stands and the coniferous dominated stands were also sampled to get a general idea of how the harvested sites differ from the controls in the two forest cover types. Sampling was done using net capture in flower patches found along the baselines and using white, yellow, and blue pan traps placed adjacent to the two permanent sample plots (PSP) closest to the centre of the compartment. Samples were caught using three different colours of pan traps to compare capture rates. As bee numbers were lower than I expected, I also caught hoverflies (Syrphidae) and bee flies (Bombyliidae), both important pollinators. Yellowjackets and hornets were also caught to prevent any exceptional hoverfly mimics to escape. When time permitted, a few burn, slash burn, and clearcut stands were sampled with net capture to provide a greater understanding of what pollinator species are present and provide insight into what may be expected next summer. Sampling flower patches adjacent to the road with a net was also done when there was extra time, again in the interest of better understanding the pollinator community at EMEND.

Currently, all of the flower data from the flower patches has been entered and all specimens caught by net have been pinned. The pinned specimens have been almost entirely grouped into morphospecies to speed up the identification process. Though I am just beginning identification, hoverflies seem to be more diverse than bees based solely on these morphospecies. The vast majority of the bees are bumblebees though some other families are also represented. Pollinator abundance seems higher in 50% retention stands than in control stands, though no statistics have been run. Bee washing gear has been set to prepare samples caught by pan traps but the majority are not complete at this moment as I have put my attention into the samples caught by net. I observed that throughout the summer the pan traps caught relatively few bees compared to net capture (and especially to published papers on pan traps) with the exception of a few days. This is likely due to the thick ground cover that reduces the visibility of the traps.

Next year, all retention levels will be sampled in one or two forest cover depending on time available to determine how pollinator assemblages respond to different levels of harvesting.

Grad Studies Activities Financials- 2012

Funding support for the 2012 grad studies activities at EMEND came in the form of a NSERC CRD agreement with cash contributions and in-kind support from Daishowa Marubeni International, and in-kind support from Canfor.

NSERC CRD BUDGET EMEND			
Reporting Period January 1, 2012 to December 31, 2012			
	2012 Budget	**2012 Actuals**	**2013 Budget**
Salary/Benefits			
Grad Student Salaries	$ 79,275	$ 65,475	$ 198,450
Field Assistant Salaries	$ 18,087	$ 8,649	$ -
Project Manager	$ 31,300	$ 21,344	$ 31,300
Salary/Benefits Sub-total	*$ 128,662*	*$ 95,468*	*$ 229,750*
Other			
Camp User Fees	$ 34,200	$ 47,671	$ 62,200
Training and Supplies	$ 4,000	$ 3,282	$ 10,000
Laboratory Expenses	$ -	$ -	$ 5,000
Vehicle Repairs & Mileage	$ 12,750	$ 16,194	$ 38,250
Publications	$ -	$ -	$ 1,100
Conferences/Travel	$ 4,000	$ 8,964	$ 9,000
Knowledge Exchange	$ 25,000	$ 7,449	$ 25,000
Core Sub-total	*$ 79,950*	*$ 83,561*	*$ 150,550*
Expenses Sub-total	*$ 208,612*	*$ 179,029*	*$ 380,300*
Payments owing for project manager		$ 2,349	
Funds to be collected for camp fees		$ (12,825)	
Total Expenses	$ 208,612	$ 168,553	$ 380,300

Planned Grad Studies Activities- 2013

The 2012-2013 year will see a resurgence of graduate work at EMEND. Approval of a joint DMI/Canfor/NSERC Collaborative Research Development Grant will help us to complete various projects currently in progress, and expand the graduate work occurring at EMEND. The EMC is also finalizing an "EMEND Grad Studies Framework" that will see enhanced clarity of roles and deliverables, and increased interaction between EMEND student researchers and partners from industry and government. This engagement will occur from the point of research project initiation, through the active fieldwork stage, as well as during the final synthesis of findings and management applications. It is intended to be a reciprocal experience where students also gain site-level insight into policy and forest management activities, and the challenges in natural resource management decisions. Currently planned graduate activities for the 2012-2013 year include:

1. **Seung-Il Lee** - ***Saproxylic beetles and coarse woody debris habitat associations in conifer stands.*** Seung-Il will focus on completing his sample identifications, data synthesis and begin to write his thesis.

2. **Sonya Odsen-** ***Song bird response to variable retention harvesting at EMEND.*** Sonya will focus on completing her final field season of data collection. She will work to complete her point count surveys as well as complete a secondary project at EMEND.

3. **Jared Amos-** ***Pollinator responses to variable retention harvesting at EMEND.*** Jared will also focus on completing his final field season of data collection, process his samples, and begin to write his thesis.

4. **Additional Students**- 2012-2013 will also see the incorporation of additional students into the EMEND graduate student mix thanks to the approval of the DMI/Canfor/NSERC collaborative research development grant. We look forward to bringing on new students to work on the biodiversity, wildlife, soils, fire, and social dimensions of the EMEND project. The NSERC CRD funding application anchors the relevance of these diverse themes to the CCFM criteria defining sustainable forest management in Canada's boreal forest, with the intent of inspiring refinement or development of science-based management tools, practices and policy. The EMC hopes this renewal of EMEND research opportunity will also prepare enthusiastic students as the next generation workforce to meet the challenges of one of Canada's flagship sectors through a highly interactive university-industry-government collaboration.

   The following table provides an overview of timelines within which students will join the EMEND program with year 1 being 2012, year 2 being 2013 etc.:

Supervisor	Student	Year 1	Year 2	Year 3	Year 4	Year 5
Spence/Acorn	MSc #1	→	→	→		
Macdonald	PDF #1		→	→	→	
Macdonald	PhD #1		→	→	→	→
Quideau	MSc #2			→	→	→
Spence/Langor	MSc #3	→	→	→		
Spence/Langor	PhD #2	→	→	→		
Ryu	PhD #3		→	→	→	→
Nielsen	MSc #4			→	→	→
Nielsen/Eaton	MSc #5			→	→	→
He	PhD #4		→	→	→	→
Armstrong	PhD #5		→	→	→	→
Spence/Langor/He	PDF #2	→	→			

5) Communications Activities- 2012

EMEND knowledge and research progress are shared among EMEND partners through a number of initiatives. Fostering a relationship of regular interaction between graduate students and EMEND partner representatives is emphasized as a critical part of the EMEND experience, from the point of forming the research project question through to development and discussion of management practice implications. Activities from 2012 included:

EMEND Synthesis Workshop

We held an EMEND synthesis workshop at the Northern Forestry Centre, Edmonton, Alberta. This workshop brought together the main authors and co-authors for the EMEND synthesis project as well as industry and government representatives on the EMC. The workshop focused on discussing the topics to be addressed in the synthesis, the structure of the synthesis and the target audience. John Spence agreed to pursue a publisher and assess the feasibility of having the synthesis published as a book.

Knowledge Exchange Activities

Through the University of Alberta, the EMC maintains a contract relationship with both nova-NAIT's Boreal Research Institute (BRI) in Peace River, and the Knowledge Exchange Program at the Department of Renewable Resources-University of Alberta, to assist the design and local delivery of specific activities set-out in an annual knowledge exchange workplan reviewed and endorsed by the EMC.

Given uncertainties around budget while we awaited word on funding approval for the EMEND CRD application, knowledge exchange activities were kept to a minimum. Our key areas of focus were:

1) The new EMEND website was brought online in June and we worked on refining and editing the main project pages.
2) Site tours: We hosted the Junior Forest Rangers on the site and both of our graduate students (Jared Amos, Sonya Odsen) presented on what it is like to be a graduate student in the field of forest management. The Junior Forest Rangers also helped to clear and renew a tour trail in Block B of the experiment. This trail provides us with an easily accessible, all weather tour trail for summer field tours.

EMEND Promotion to Prospective New Partners

The EMC continued to pursue a variety of oil and gas stakeholders and made efforts to convey the value of the EMEND project to them. Of particular mention, Jim Stephenson spoke with Garth Davis (Connoco Phillips) and developed a better appreciation of the challenges faced by the oil and gas industry. Similarly, Tim Vinge continued to communicate the benefits of EMEND to the Oil Sands Leadership Initiative (OSLI) and pursued other opportunities to integrate EMEND knowledge into various oil and gas activities. Broader engagement with these companies continues to be a priority for the EMC.

Scientific Communications

A number of refereed publications were developed using EMEND data sets:

Pinzón, J, JR Spence & DW Langor. 2012. Responses of ground-dwelling spiders to variable retention harvesting practices in the boreal forest. Forest Ecology & Management 266:42-53.

Solarik, K, WJA Volney, VJ Lieffers, JR Spence & A Hamman. 2012. What factors influence the mortality of trees 10 years after variable retention harvest in the boreal forest? Journal of Applied Ecology 49: 145-154.

Chavez, V, & SE Macdonald. 2012. Partitioning vascular understory diversity in boreal mixedwood forests: the importance of mixed canopies for diversity conservation. Forest Ecology and Management 271: 19-26

Oral Presentations

In addition to refereed publications, reputations in science are built through presentations made at scientific meetings. These are examples of presentations made during 2012. In subsequent reports we will try to provide a fuller list of these activities.

Spence, JR. EMEND: An experimental approach to evaluating biodiversity impacts of forest disturbance. International Conference on Biomedical and Environmental Sciences & Technology, Sun Yat Sen University, Guangzhou, PR China, 19 April 2012. (Invited, Audience: c. 150)

Spence, JR. Biodiversity conservation in a sustainable forest management framework: speculation, science and experiments. Keynote Address, Second International IUFRO Congress on Biodiversity in Forest Ecosystems and Landscapes, 31 August 2012 in Cork, Ireland (Invited, Audience: c. 240)

Lee, S-I, JR Spence & DW Langor. Conservation of saproxylic beetles and living tree retention patch size in boreal while spruce forest. Symposium entitled "Invertebrates in forest litter and coarse woody debris", held as part of Section 7 at XXIV International Congress of Entomology, 25 August 2012 in Daegu, South Korea.

Lee, S-I, JR Spence & DW Langor. Thresholds for living tree retention patch size to maintain saproxylic beetle diversity in boreal white spruce stands. Joint Annual Meeting of the Entomological Society of Canada and the Entomological Society of Alberta, 6 November 2012, Edmonton, Alberta.

Pinzon, JH, SB Bourassa & JR Spence. Ground-dwelling arthropod assemblages following variable retention harvesting: Is green tree retention effective to maintain biodiversity? Symposium entitled "Invertebrates in forest litter and coarse woody debris", held as part of Section 7 at XXIV International Congress of Entomology, 25 August 2012 in Daegu, South Korea.

6) EMEND Infrastructure

EMEND partners and researchers benefit from a range of infrastructure representing capital investments that support field activities and promotion. These include a University base camp and field lab (equipment, buildings), a temporary camp site, the research forest site compartments, all-weather road access, All Terrain Vehicles, and a visitor staging area. The project also relies on a website for storing and sharing data and project information. It is important that the EMC maintain an eye on the condition of these fundamental elements supporting the research effort.

a) Field Infrastructure- During the 2012 year, we undertook a variety of activities to address looming infrastructure purchase challenges such as the renewal of our ATV fleet and the purchase of new tents for the EMEND base camp. We were successful in our application to the University of Alberta for funds to support the purchase of two new core crew quads and five new canvas tents for the EMEND camp facility. Additional quads will need to be purchased as the fleet is aging (see below), however this represents an initial point from which we can start the fleet renewal process.

Type	Brand	Description	Year	Serial No
Quad	Honda	2005 TRX500FES, YELLOW	2005	1HFTE318254000771
Quad	Honda	2005 TRX500FES, YELLOW	2005	1HFTE318354000729
Quad	Honda	2005 TRX500FES, YELLOW	2005	1HFTE318354000259
Quad	Honda	2005 TRX500FES, YELLOW	2005	1HFTE318654000286
Quad	Honda	Red Honda from DMI	2004	478TE226144502180
Quad	Honda	Yellow Honda from DMI	2004	478TE256X4A400986
Truck	GMC	Suburban		UofA 290
Truck	Chevrolet	2500	2008	UofA 260
Trailer	RT Trailers	ATV Trailer, two axle, 16' long	2005	

b) Enhanced protection of the research forest lands (7000ha) and collective EMEND research investments in this site remain an important action item that Alberta SRD (Stadt) continued to pursue in 2012. A significant amount of time and energy was invested in moving a revised PNT application forward. Target submission of this revised PNT application is early 2013.

c) EMEND Website- Following a thorough gap assessment and quantification of needs from our website, a new website was launched in the summer of 2012. Although edits and small adjustments continue to be made in an effort to improve the site further, this new site is a major step in improving our image to individuals outside of EMEND.

d) Base Camp- Historically, the base camp has been operated and maintained by local contractor resources during the active season, and demobilized for winter. The operating costs of this EMEND facility were divided up based on a user fee/person/day at EMEND and costs were assigned to respective research programs. Given current funding realities, this seems to be the way the EMEND camp will be required to run in the coming years.

7) EMEND Safety

This year proved to be a major year for the EMEND safety program as we initiated a complete ground up review of our safety program. The intent was on reviewing our past programs and developing a system that would capitalize on learning's from past events and ensure efficient communication of safety priorities to our staff and students in the field at the EMEND site.

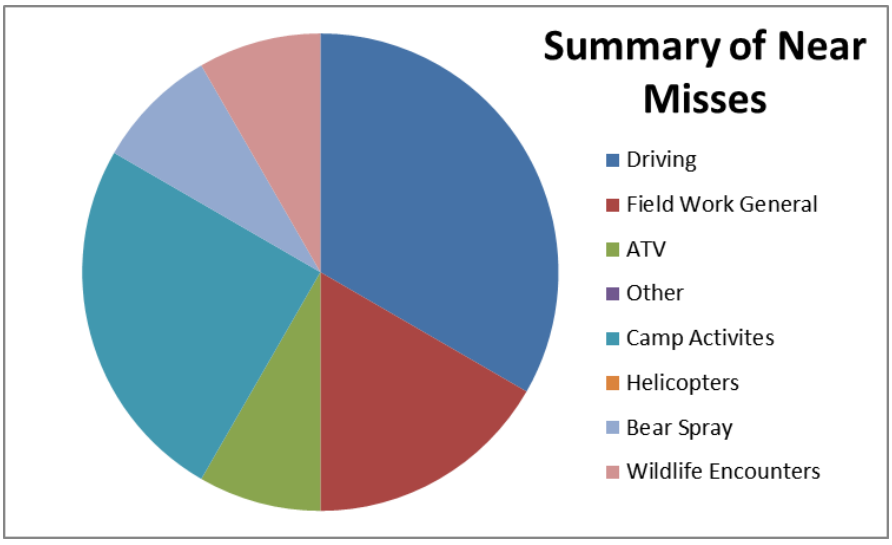
With the help of Mr. Gord Winkel, past VP of Environment, Health and Safety at Syncrude Canada Ltd and now with the Faculty of Engineering at the University of Alberta, we have been developing an industry leading safety program for EMEND. Work to date has included the development of: an inventory of hazards, an impact table and a risk matrix. These tools will then be used to develop appropriate risk reduction measures for the staff at EMEND. The

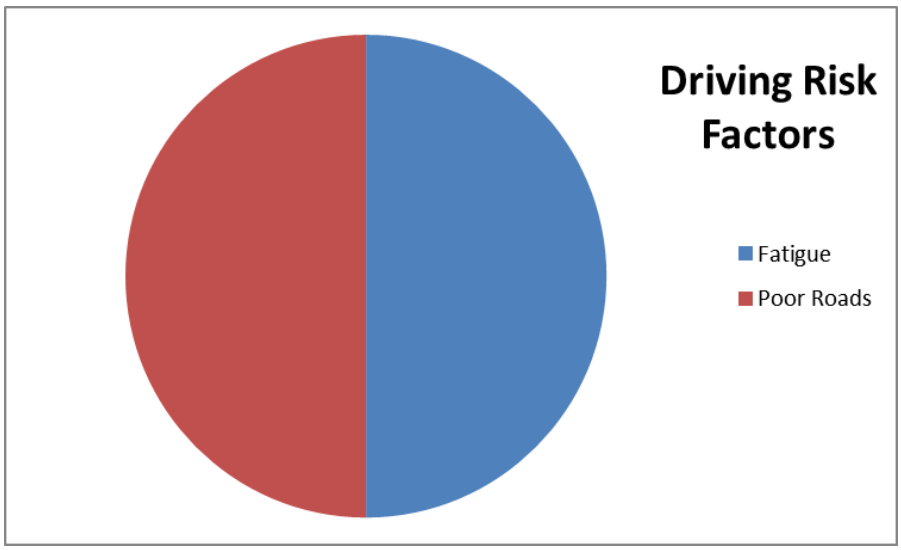
program will be completed by the spring of 2013 and will be implemented for the 2013 field season.

Through this review, the EMC also reviewed events and near misses from the 2012 field season in an effort to begin documenting patterns which may emerge from field activities at EMEND, and take preventative actions where possible.

2012 EMEND Safety Incidents/Near Misses

- Two times students almost went into the ditch when roads were muddy
- Students almost hit the ditch at end of day – fatigue a factor
- One driver almost fell asleep when driving home – fatigue a factor
- A student that was turning their quad around on road could feel the weight shift- needed to go slower
- On student bear sprayed himself – got lost for 1 hour, alder bushes ripped off cap on bear spray, tripped on log, 2 minutes later started coughing
    - Got on hands and affected breathing, no major issues
- Bear encounter where student yelling triggered it but it left – didn't care about her
    - Suggestion to use bear bells
- A student had a branch almost poke him in the eye, caught side of head- student was wearing safety glasses and they helped prevent injury
- Student swung leg over log and caught it on a branch on the other side- just a stub but very painful
- Gas guy came out, forgot to re-light pilot light on stove and had to open windows etc.
- All windows were locked in rooms with no key, so if an issue, couldn't get out of window
- Smoke detectors were going off and need to be replaced
    - Hard wired into the power
- Student almost hit deer early in morning- could maybe get whistles to put on the trucks





8) EMEND Management

EMEND continues to see direction occur through an EMEND Management Committee comprised of representatives from partner organizations. Program management occurs through the University of Alberta representative, with science leadership direction shared by the University of Alberta and Natural Resources Canada –NoFC. EMC members in 2012 included:

- Tom Archibald (Foothills Research Institute)
- Shawn Barraclough (Alberta ESRD –Peace River)
- Jim Stephenson (Canfor)
- Dr. Dave Langor (NRC, NoFC, CFS)
- Matthew Pyper (UofA Knowledge Exchange)
- Dr. John Spence (UofA)
- John Stadt (Alberta ESRD –Forest Management Branch)
- Tim Vinge (Alberta ESRD –Lands Branch)
- Jim Witiw (DMI)
- Associate: Jean-Marie Sobze (novaNAIT Boreal Research Institute, AFEX)

Administration of the EMEND program continued in 2012 via a shared position with the Department of Renewable Resources. Matthew Pyper committed approximately 30% of his time to the EMEND project to assist with EMEND administration, field management, work planning and reporting routines. Matthew has also taken a lead role in coordinating and maintaining momentum on a variety of key EMEND activities, to ensure critical dates and routine functions are addressed.

9) Summary

The 2012 year was in many ways a transition year for EMEND as we renewed graduate student participation at the EMEND site and made significant progress on the EMEND 10 year synthesis project. The EMEND project was successful in obtaining both an NSERC CRD award (~$1.7 million over five years) and an infrastructure support grant from the University of Alberta ($115,750) over three years. Both of these awards will help to bolster the program at EMEND and help us to build on and continue the world-class research already conducted at EMEND.

The partners are also very proud of the progress being made on our revamped field safety program. Safety has always been front and centre at EMEND, however this year presented us with an opportunity to strive to do even better in delivering an industry leading safety program at the EMEND site. Through the assistance of Mr. Gord Winkel at the University of Alberta, and the extensive inputs of Matthew Pyper and John Spence, we feel we are building a program that will set an example for other field programs to strive towards. As with many things at EMEND, we are leading the way by charting new waters and developing a world-class and high-profile internationally recognized research program that contributes directly to forest management planning in Alberta.

Appendix 1

Burns summary and reporting table for EMEND:

Burn Date	Block (#)	Canopy Composition	Area Burned (%)	Description	Status -2011
4/8/1999	926	CDOM	70%	Patchy burns in some areas.	Complete
26/04/00 & 14/05/10	943	ADOM	70%	Unsuccessful first attempt.	Complete
26/04/00 & 14/05/10	944	ADOMU	<10%	Burn attempted twice, but poor results.	Pending
1/7/2004	937	MIX	50%	N/A	Complete
18/05/06	883	ADOMU	50-60%	N/A	Complete
18/05/06	891	CDOM	40-50%	Unburned area Ğ very wet.	Complete
18/05/06 & 17/10/10	901	MIX	<20%	Poor burning on both attempts.	Pending
14/05/10	945	ADOMU	<20%	Poor burning, only edges were burned.	Pending
13/05/10	857	ADOM	<10%	Poor burning.	Pending
12/5/2010	865	ADOM	50-60%	Poor burning after number of attempts.	Complete
12/5/2010	866	ADOM	50-60%	N/A	Complete
N/A	872	MIX	N/A	Site has been way too wet to attempt to burn.	Pending
N/A	915	CDOM	N/A	Never attempted, too wet.	Pending
N/A	960	ADOMU	N/A	Never attempted, too wet.	Pending